THE STORY OF

Wright Aero

Tracing the growth of the
WRIGHT AERONAUTICAL CORPORATION

By JOHN H. VAN DEVENTER, Jr.
Associate Editor
AIR TRANSPORTATION

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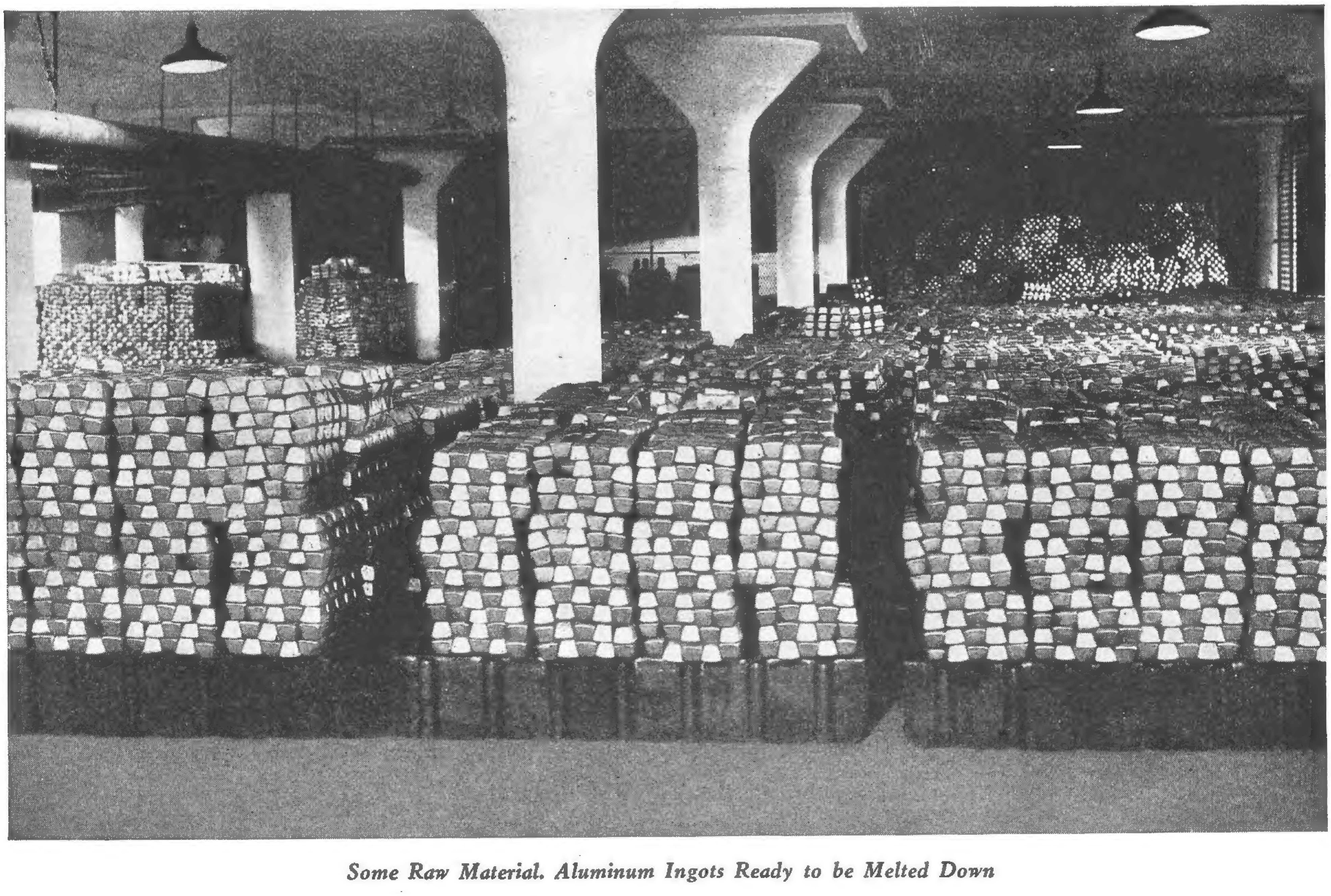
ON a blustery day in December, twenty-five years ago, a human being flew under controlled power for the first time. Thus did the Wright Aeronautical Corporation begin.

And since that raw 17th of December on the sand dunes of Albemarle Sound at Kitty Hawk, the names of "Wright" and "flying" have always remained synonymous. The name of Wright has been perpetuated in a living, growing monument to the progress of civilization in the Wright Aeronautical Corporation.

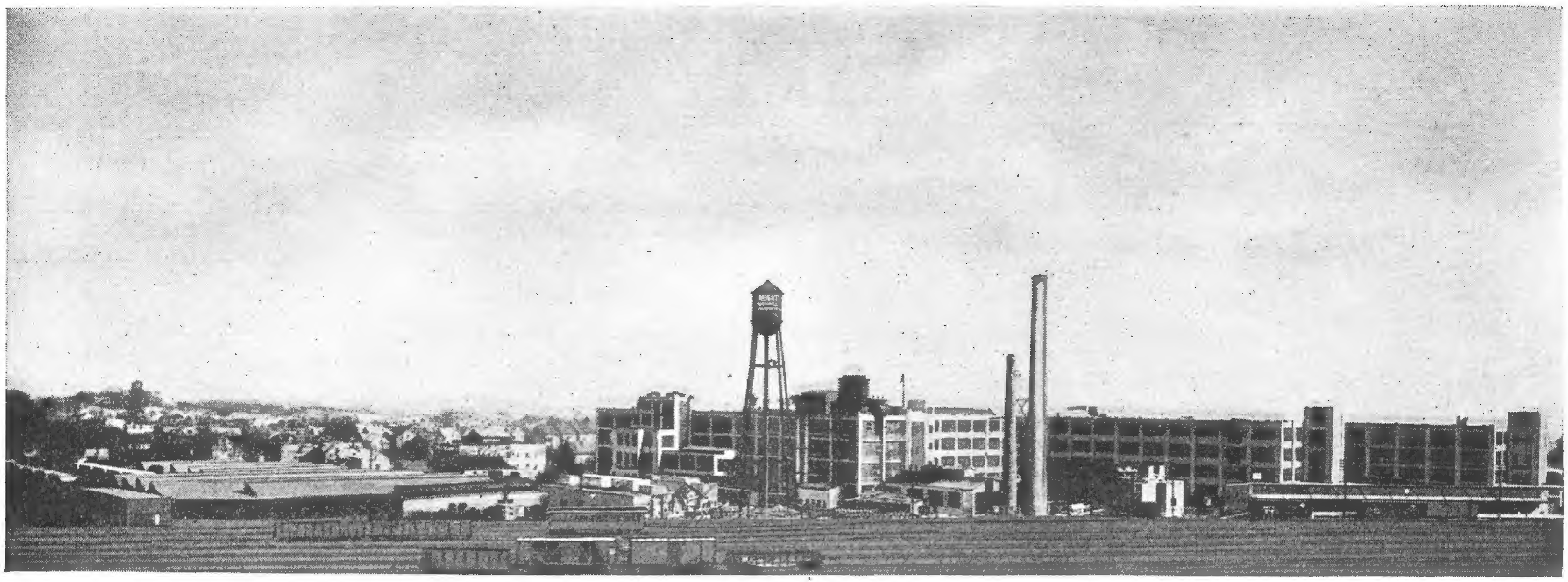
The story of the first flight is well-known; it needs no repetition here. But the story of the growth of the Wright Aeronautical Corporation and the picture of it as it is today is the story of the beacon that illuminates the first twenty-five years of flying, and stands for all that aviation can mean to the world.

Six years after the first flight, the Wright Company was organized. It was capitalized at $1,000,000, and was controlled by Orville and Wilbur Wright. In 1915 the Wright Brothers sold their stock to a syndicate headed by William B. Thompson, Harry Payne Whitney and T. Frank Manville. To insure engines of a high standard the company had also obtained control of the Simplex Automobile Company and plant at New Brunswick, New Jersey, employing 2,200 skilled mechanics.

The great influx of airplane and engine orders from Europe



Some Raw Material. Aluminum Ingots Ready to be Melted Down



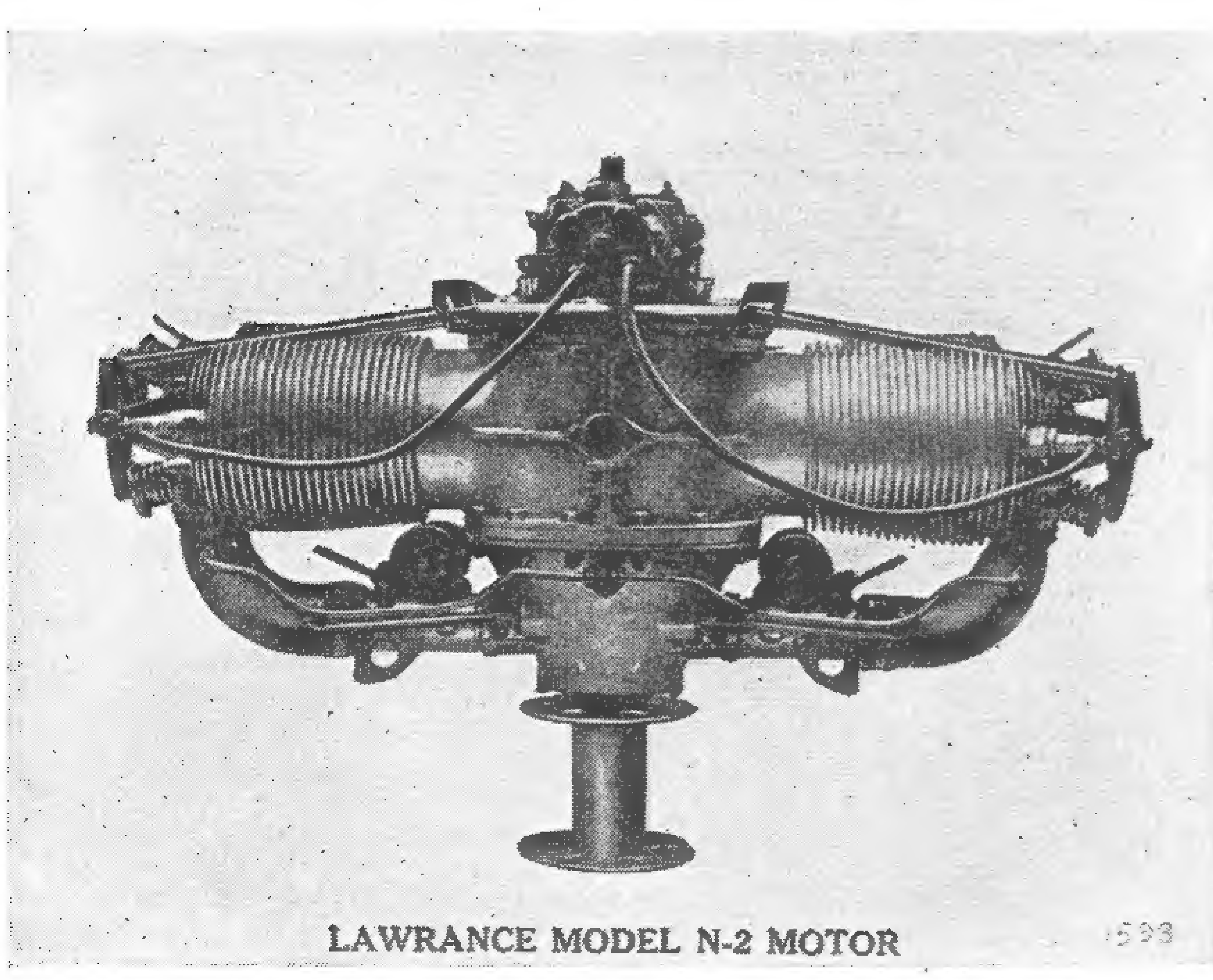
Main factory of the Wright Aeronautical Corporation at Paterson, N. J., U. S. A.

convinced American business men that the industry must be enlarged. In August, 1916, there was formed the Wright-Martin Company of Los Angeles, the Wright Company merging with the Glenn Martin Company of Los Angeles, which was then producing ten airplanes monthly. The new company took over the original Wright Company, owning all Wright patents, the Simplex Automobile Company, the stock of the Wright Flying Field at Mineola, Long Island, and the General Aeronautic Company of America, which handled the foreign business of the Wright Company. The Wright Company at Dayton, Ohio, continued experimental work with Orville Wright as chief consultant engineer.

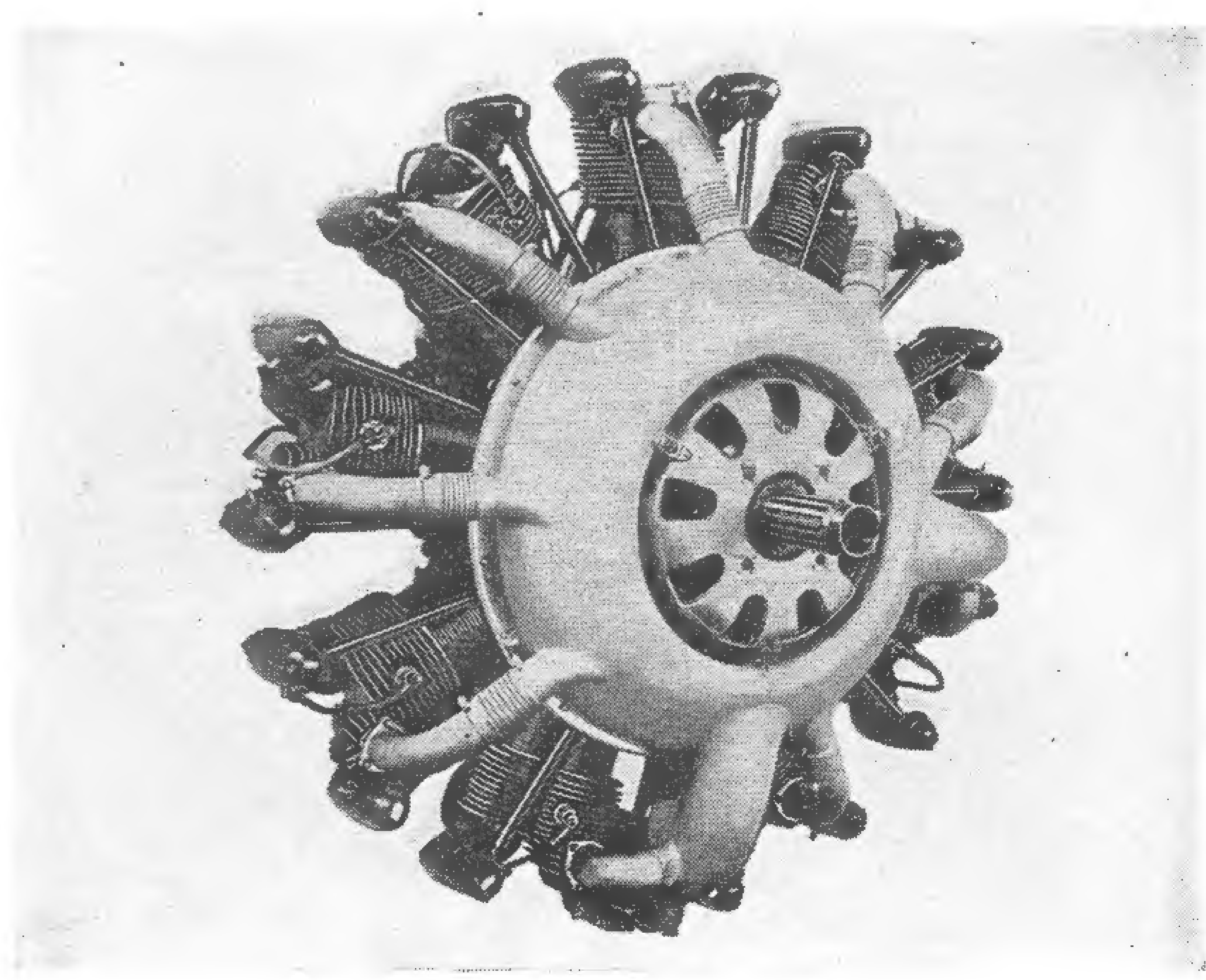
Edward M. Hagar became the new president in May, 1917, with George M. Houston as vice-president and general manager. Mr. Houston later became president. Henry M. Crane, originally of the Simplex Company and one of America's foremost engineers, became vice-president and chief engineer, with Richard F. Hoyt as secretary and assistant to the president. Guy Vaughan, now vice-president and general manager of the Wright Corporation, came into the organization in 1917 as quality manager. Mr. Hoyt continues his association as Chairman of the Board of Directors.

After a careful study of the airplane industry and its relationship to the World War, these men became convinced that America's interest lay in furnishing in large quantities to European nations the best possible aviation engines. France and England could build planes but their lack of mechanics and especially their lack of experience with quantity production made the manufacture of engines slow and unreliable.

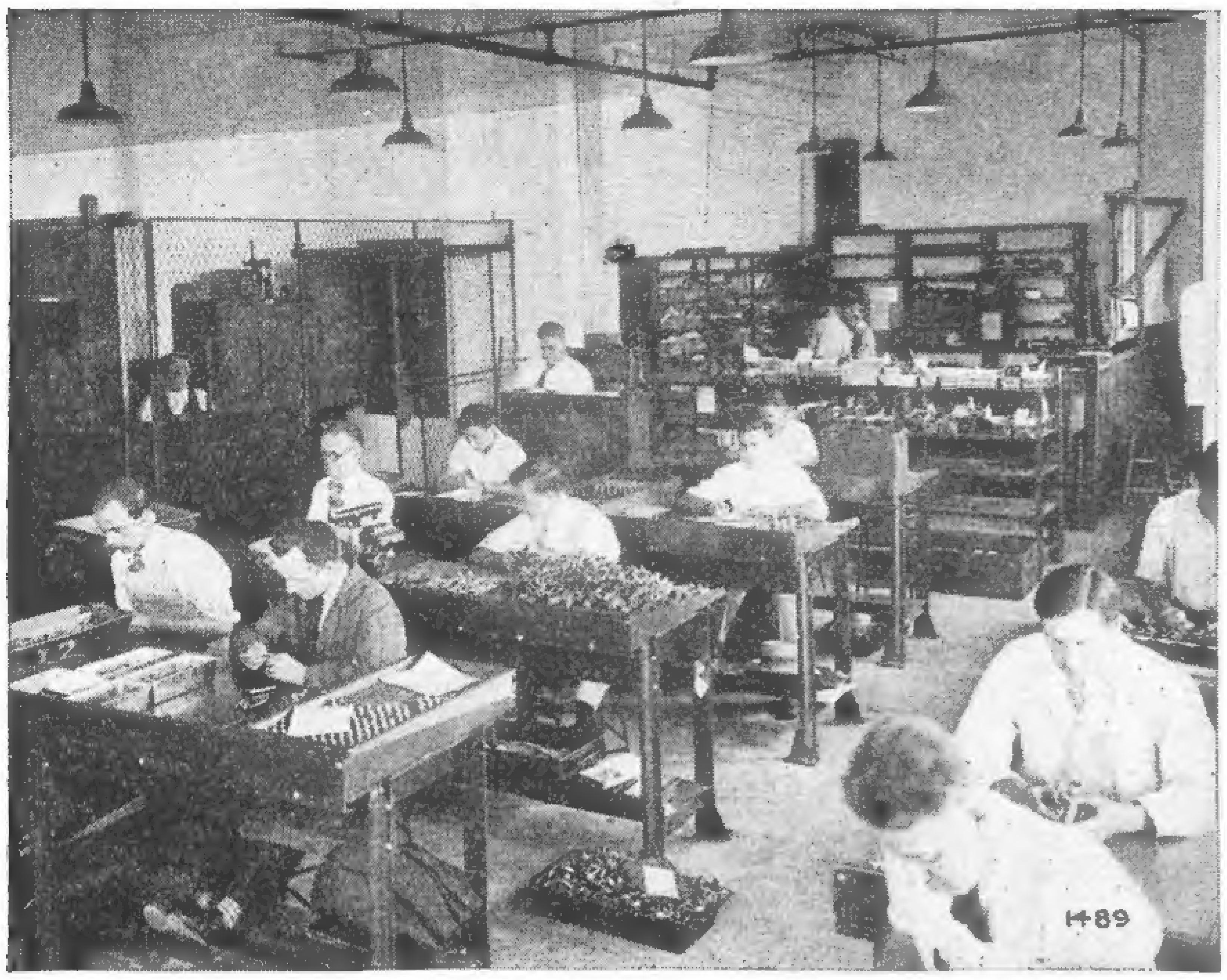
Two representatives of the General Aeronautic Company, a subsidiary of the Wright Company, had in 1916 surveyed the field of European aviation engines and had convinced themselves that the most adaptable for war purposes was the Hispano-Suiza, designed by a Swiss engineer, Marc Birkigt, in September, 1914, a month after the opening of the World War. The name was derived from the early experimental work



The First Lawrance Air Cooled Radial Engine



The Latest—525 h.p. Cyclone Engine



A corner in the Wright Inspection Department

done in Switzerland and the capital for its production drawn from Spanish sources, hence the "Spanish-Swiss" nomenclature.

The Hispano-Suiza was the result of search for a motor of the fixed type, nearly all other aviation motors being of the rotative type. A perfect score in fifty-hour tests upon two models convinced the French that this engine was needed and orders for 800 were placed by the French Air Service in December, 1915, and January, 1916. Subcontractors were needed for production and Italy, England, and Japan aided French factories in the work. It was then that America entered into production with an order to the General Aeronautic Company for 450 of the engines.

It was this order and the necessity of entering immediately upon quantity production that led to the formation of the Wright-Martin Company and a subsequent expansion to meet wartime emergencies of our own that excited the admiration of the American mechanical world.

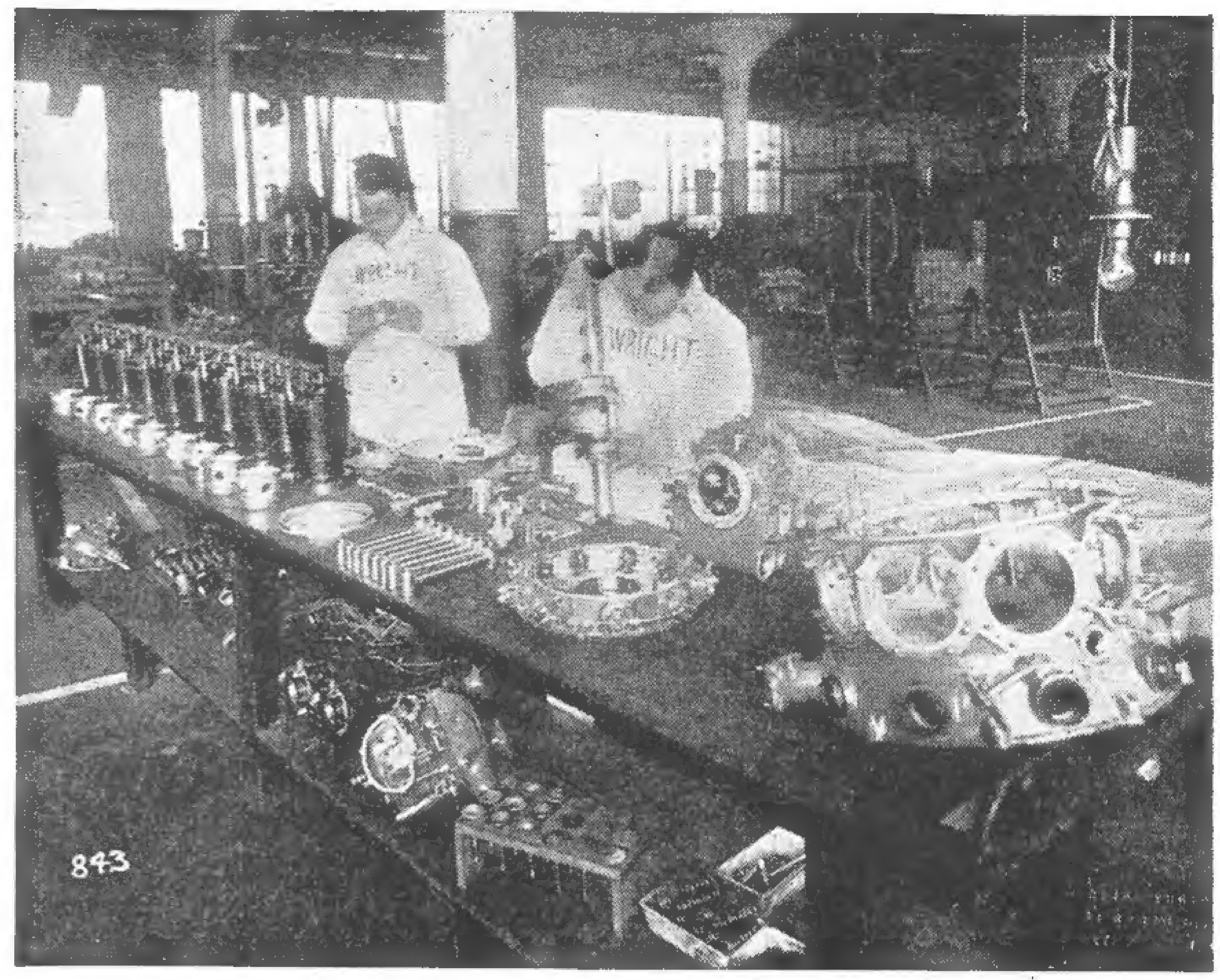
To get into production proved to be very difficult and costly, largely due to the extreme stringency of the specifications on material and there was considerable delay. Up to July, 1917, less than 100 motors had been shipped to France. The rapid development of the Hispano-Suiza motor in America really dates from May, 1917, when the management of the undertaking was given to the firm of George Goethals & Company, with their representative, Mr. Houston, as mentioned above, becoming general manager.

Assembling Crankcases

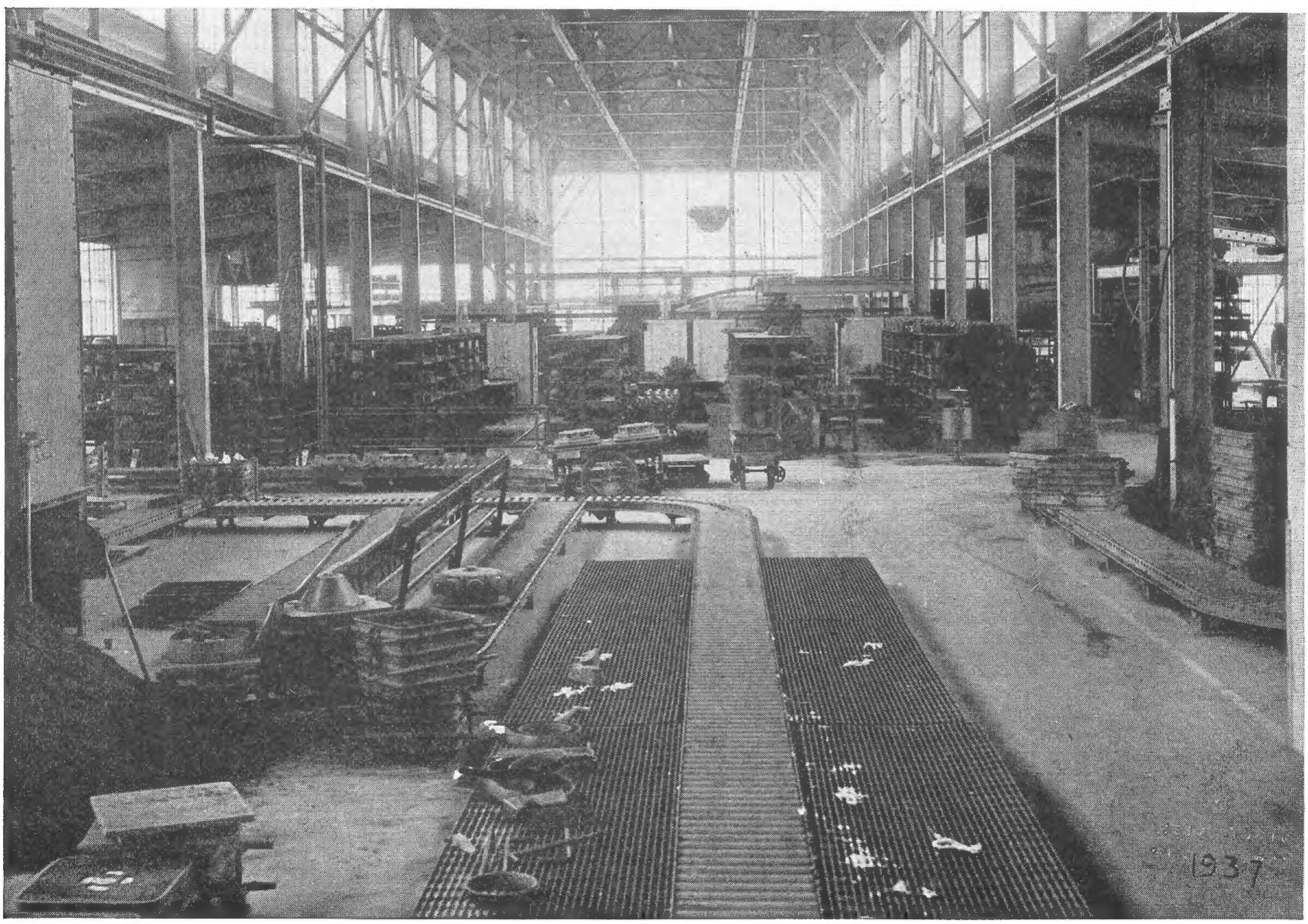
When the first order came from the United States Government in July, 1917, engines on the French order were being produced at a steadily increasing rate and the American orders were accepted with the certain knowledge that the motors could be shipped within a definite and reasonable time. The end of July, 1917, saw the Wright-Martin Corporation with nearly 1,000 motors on order all of exactly the same type. The success of the Hispano-Suiza abroad made it certain that more orders from that source would be forthcoming, and accordingly the American company scheduled itself for a large organization and big equipment.

One difficult point, however, was the uncertainty as to whether the 150 or the 200 horsepower engine would be wanted because this, to some extent, affected the tools and material required. The management very wisely decided to ignore the possibility of changes and went ahead on the assumption that the 150 horsepower engine was going to be wanted all through the war; subsequent events proving the correctness of this view. The burden fell upon the tool and jig designing department which had to continually improve the methods of manufacture of the 150 horsepower engine and at the same time have ready all plans for the 200 horsepower.

From July to November, 1917, was a period of concentration upon the 150 horsepower job. By the end of the year, through the erection of some new buildings, the increasing of the tool equipment and the re-arrangement of the old equipment, together with the gathering around Mr. Houston of an



Service Department showing engine torn down for overhaul



Part of the Wright Foundry

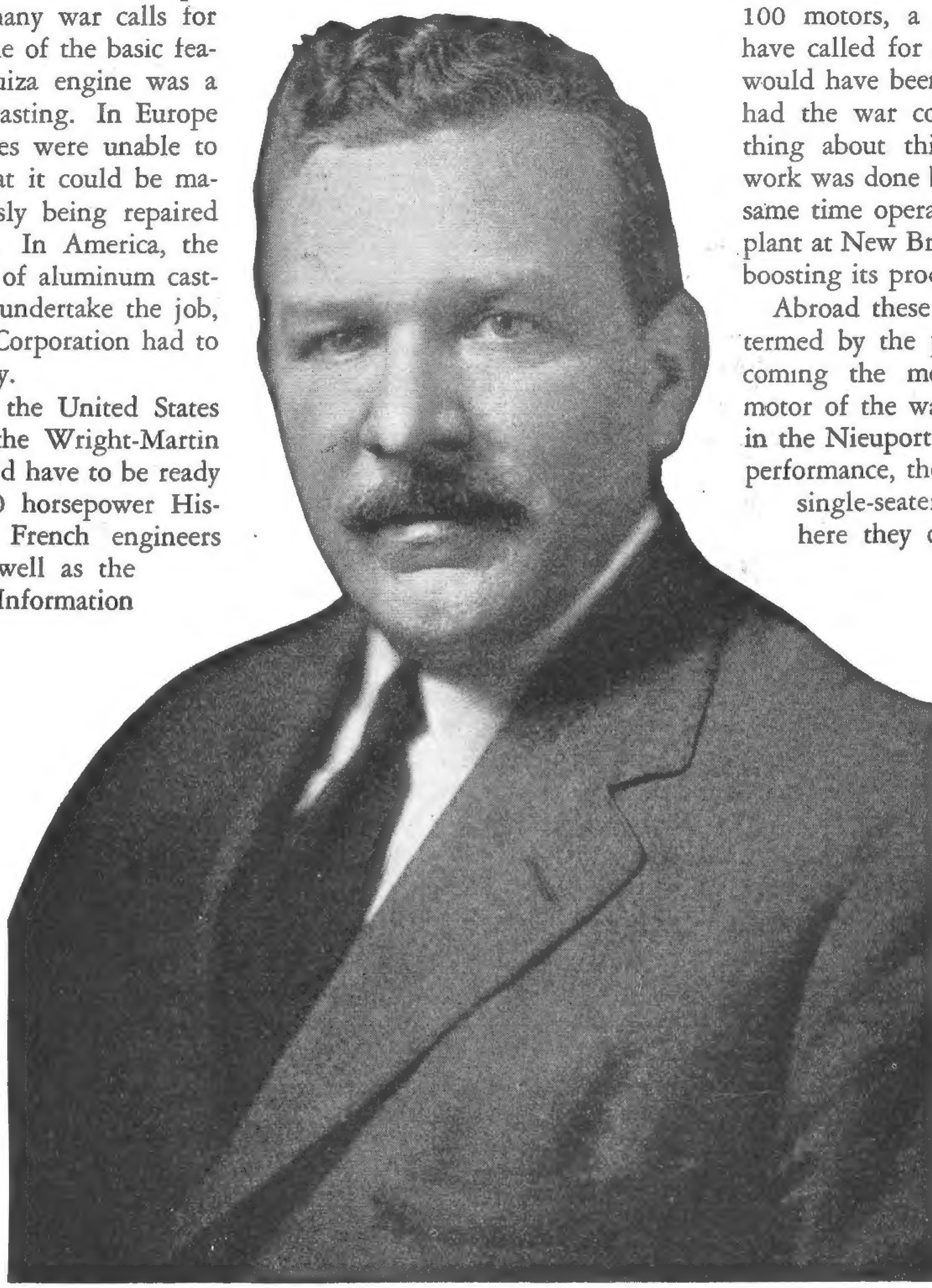
exceptional executive staff, the new company was in an extremely strong production position.

It must be remembered that in 1917 there were few men in America with any experience of so intricate a manufacturing proposition as an aviation motor and this made it difficult to obtain much assistance from outside, especially in view of the many war calls for mechanical workers. One of the basic features of the Hispano-Suiza engine was a complicated aluminum casting. In Europe the best of the foundries were unable to produce this part so that it could be machined without previously being repaired by difficult hand work. In America, the usual sources of supply of aluminum castings were unwilling to undertake the job, so this Wright Martin Corporation had to establish its own foundry.

In November, 1917, the United States Government informed the Wright-Martin Corporation that it would have to be ready to manufacture the 300 horsepower Hispano-Suiza, on which French engineers had been working, as well as the 150 horsepower type. Information regarding the new 300 horsepower job came through slowly from the French but the Wright engineering department went ahead on such drawings as they could obtain, meanwhile the jigs and fixtures being laid out simultaneously so no time would be lost.

Uncertainty as to where the 300 horsepower engine would fit into the American aviation program held up the drawings but the management, instead of expending all energy upon the smaller motor, considered the larger powered engine as possessing such capabilities that early in 1918, rather than wait longer upon the French, they proceeded to finish the designs of the 300 horsepower introducing some features differing from the French but which afterwards proved to be improvements.

Final tests of this engine gave a remarkable performance and shortly afterward the French and British governments decided to utilize the motor and in May, 1918, the Wright-Martin corporation received authority to put the new motor into quantity production. The impracticability of adding during wartime to the New Brunswick plant led the company to take over the government owned factory in Long Island City formerly occupied by the General Vehicle Company. The buildings were taken over in May. By the middle of July they had been prepared to receive new equipment and by October the plant was full of tools, large additions had been made, and all was set for a monthly production of 100 motors, a schedule which would have called for nearly 15,444 men and would have been reached early in 1919 had the war continued. The amazing thing about this record was that the work was done by men who were at the same time operating the parent Wright plant at New Brunswick and continually boosting its production.



Charles L. Lawrance, President of the Wright Aeronautical Corporation

Abroad these "Hissos", as they were termed by the pilots, were rapidly becoming the most prominent fighting motor of the war. As their installation in the Nieuport two seater proved their performance, they were also tried in the single-seater combat "Spad" and here they came into their greatest usefulness when the French leading aces drove them to victory over the enemy. A comparison of the Hispano-Suiza with the German Mercedes showed the former with 500 less parts and one-third less weight in the raw material state, two important factors in the lessened cost of material and reduced cost of production in machining.

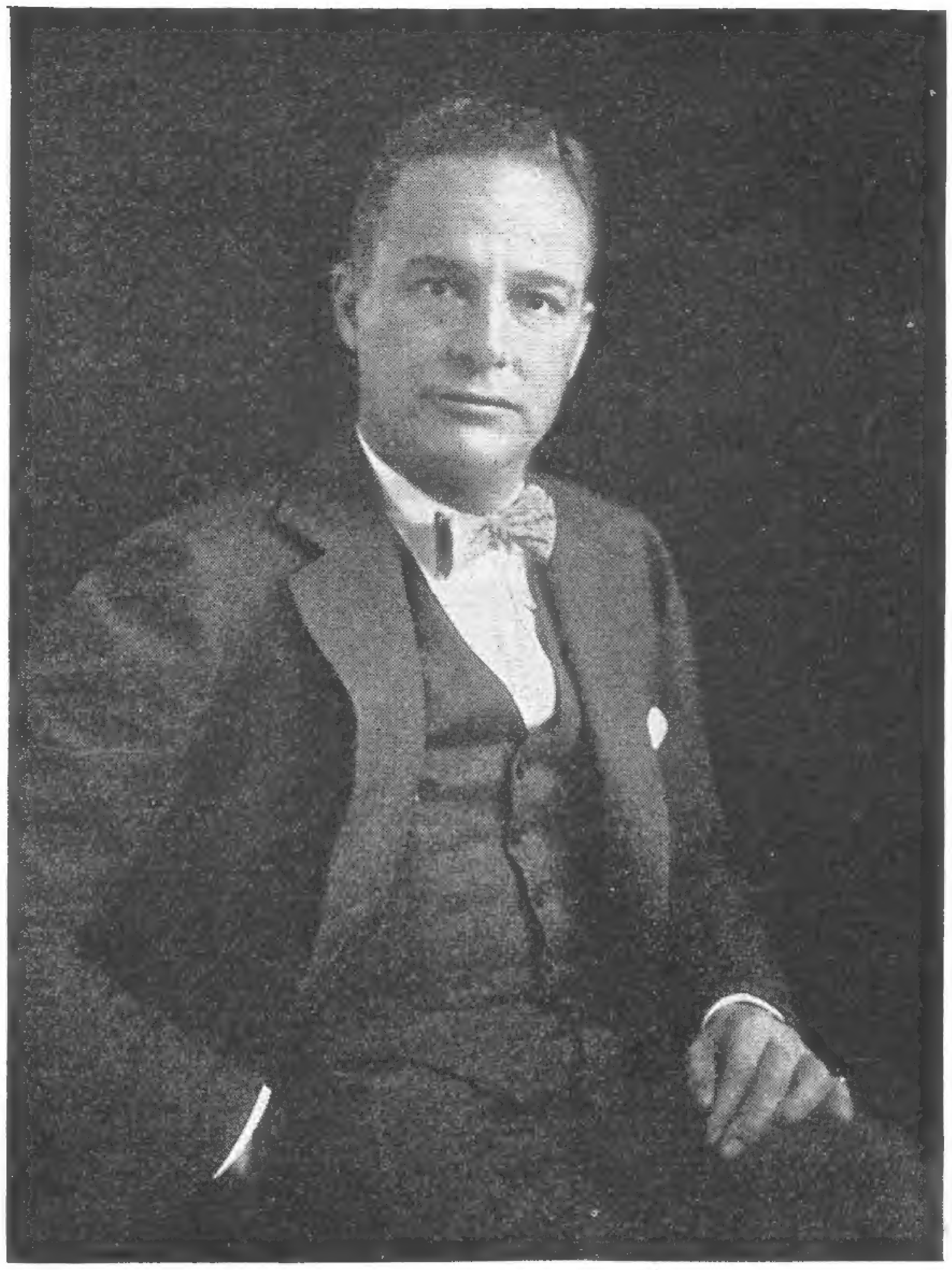
Among the most enthusiastic of the Hispano-Suiza admirers was the great French ace, Georges Guynemer. His famous battle-plane "Vieux Charles" (Old Charley) powered with an Hispano-Suiza, is in one of the War Museums of Paris as a permanent exhibit of the highest fighting efficiency of airplane in the World War. Other French aces—those having more than ten victories—who used the Hispano-Suiza were Fonck, Nungesser, Madon, Boyau, Guerin and Herteaux.

A summary of the war work of the Wright-Martin corporation is interesting. From an Hispano-Suiza motor production of about \$2,000,000 value per year in September, 1917, an increase to about \$50,000,000 per year had been made in the new Brunswick factory alone by October, 1918, and this

despite a large decrease in the price paid per motor.

From an order for a few hundred motors on the books in the summer of 1917 the corporation had a schedule for the summer of 1919 calling for all the engines they could make or get help to make—a total of about 2,000 a month and spares. At the declaration of the armistice orders on the books totalled about $50,000,000. Few undertakings in aircraft manufacture have been more successful from a business viewpoint.

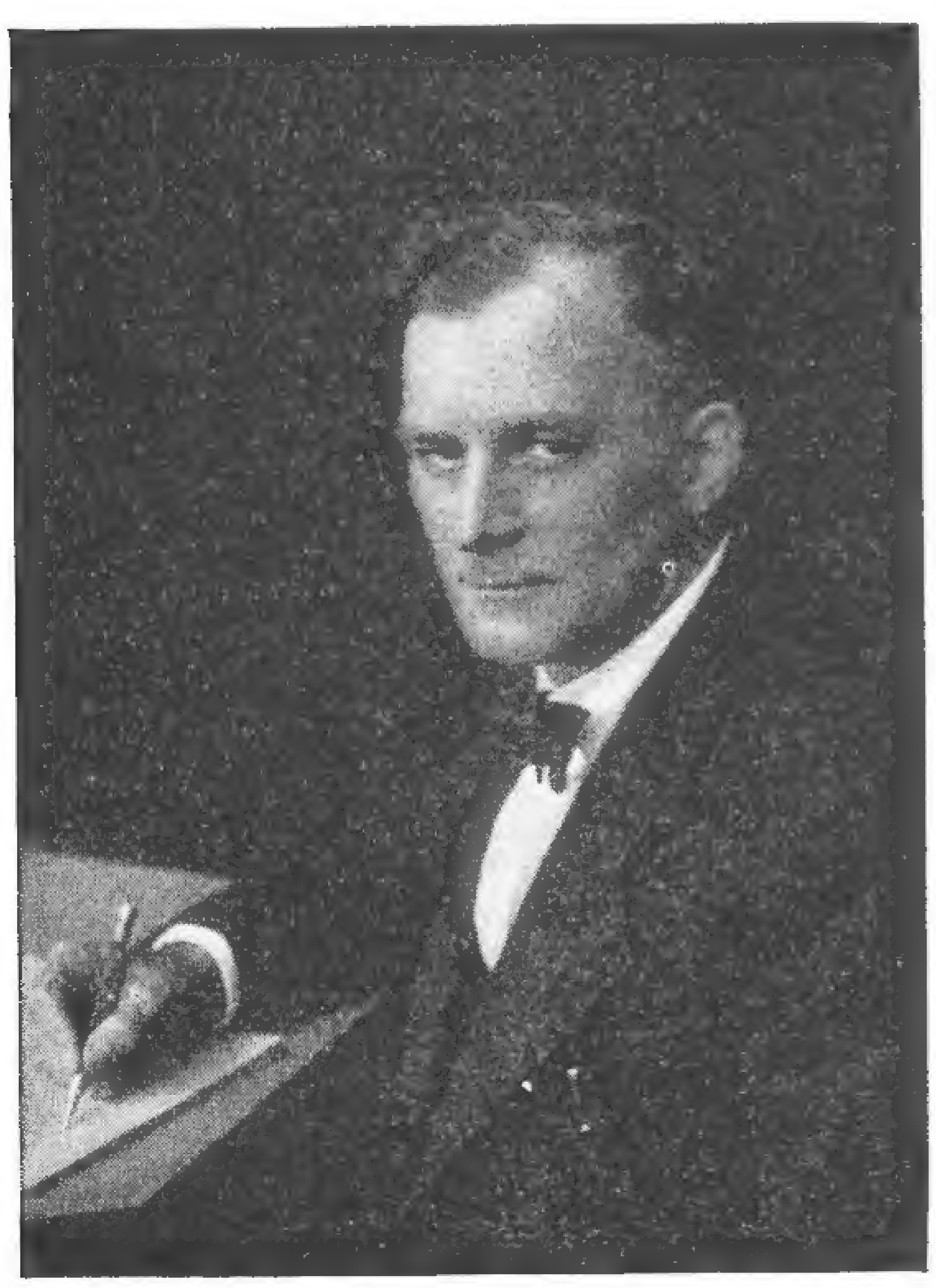
The armistice found the Wright organization functioning at the maximum for war deliveries. There was, as in other industries, an immense let-down of staggering proportions. Aviation had grown so tremendously during the war, production had been so prolific, that the wartime surplus and the consequent cheapening of planes and engines gave the industry a problem of intense seriousness. Reduction of army and navy personnel made impossible a continuation of orders on anything like the scale previously determined. Not only did military orders cease, but the authorities threw upon a market of small size engines with which no manufacturer could compete; Europe, too wished to dump surplus material upon us.



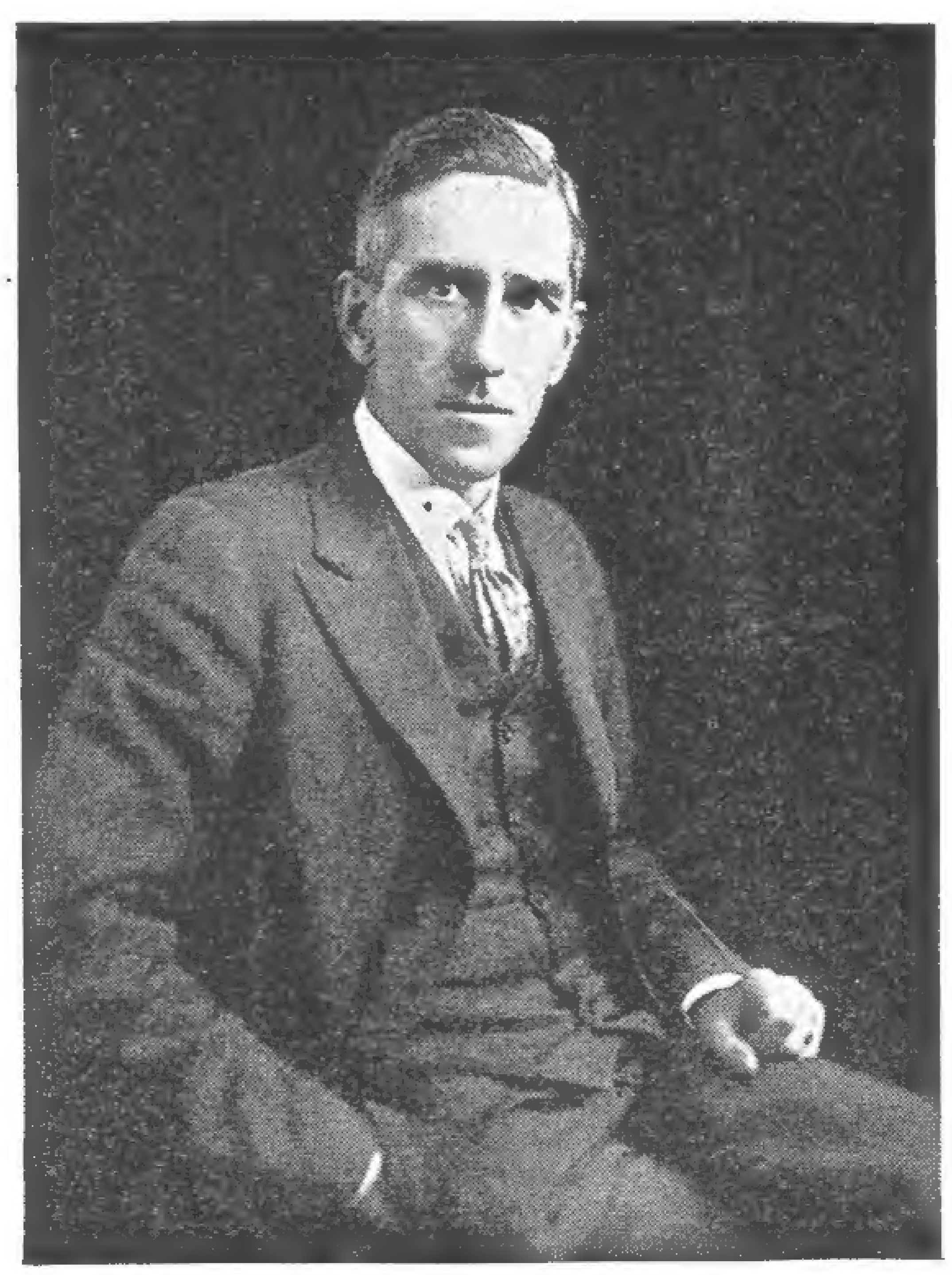
Guy Vaughan, Vice-President of The Wright Aeronautical Corporation

It was a hard experience, but the Wright Company, its faith strong in the future of aviation and in its own products, weathered the storm which swamped the smaller, less stable aeronautic concerns.

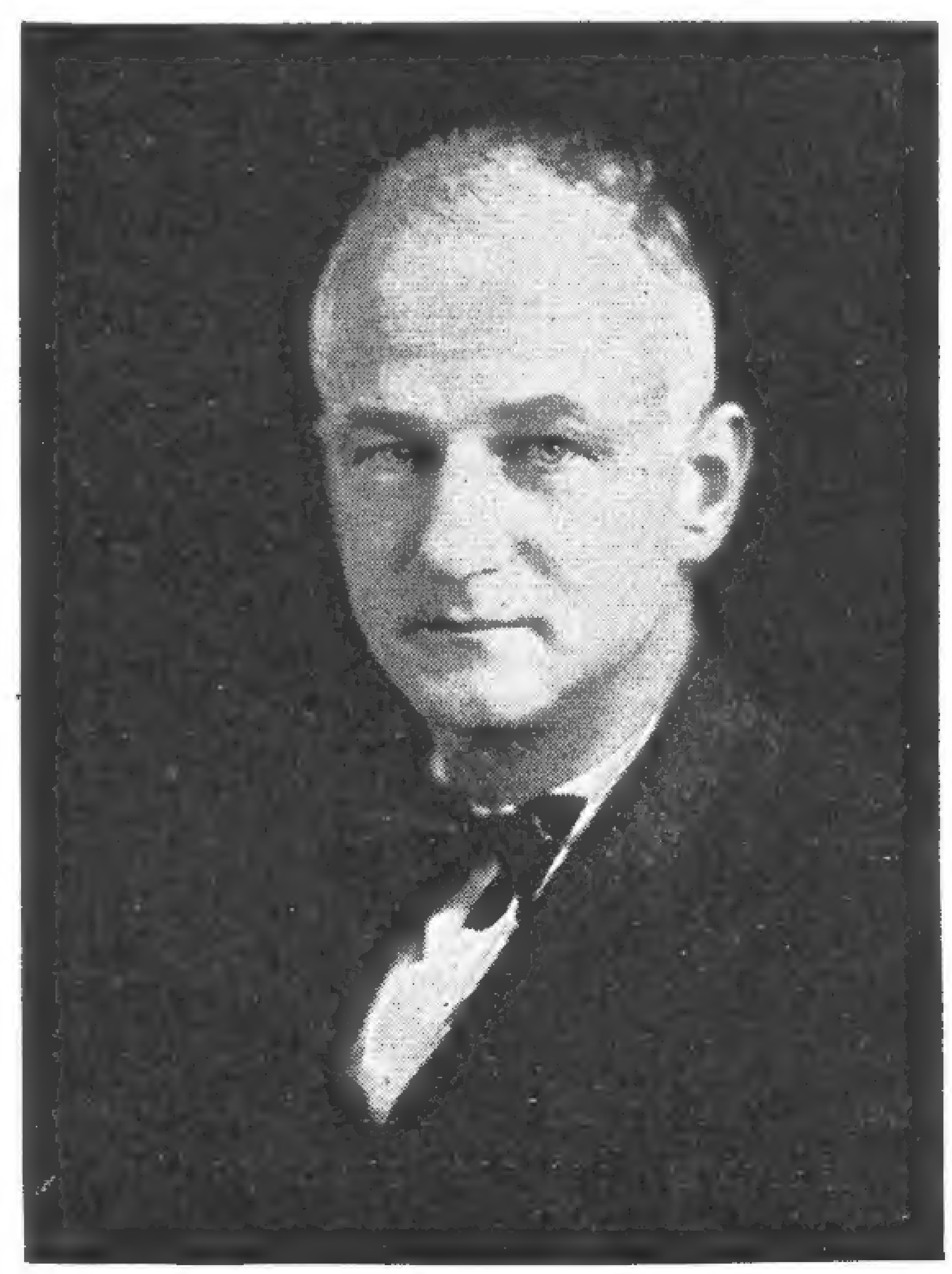
For one thing, the Wright organization knew that in the Wright-Hispano it had an engine capable of even further development and therefore of continuing value to the military and naval arms of the country. It was in September, 1919, that Major R. W. Schroeder at Dayton, using one of these engines, broke the then existing altitude record by reaching 28,900 feet. The Hispano-Suiza in America had also won credit in a 5 hours 48 minutes non-stop flight, covering 465 miles, flown by Major Norman J. Boots. Another remarkable performance — for that period—was the non-stop flight of the U. S. Navy dirigible C-I from Rockaway Beach, N. Y., to Key West, Florida,



L. M. Beatty, Factory Manager



E. T. Jones, Chief Engineer

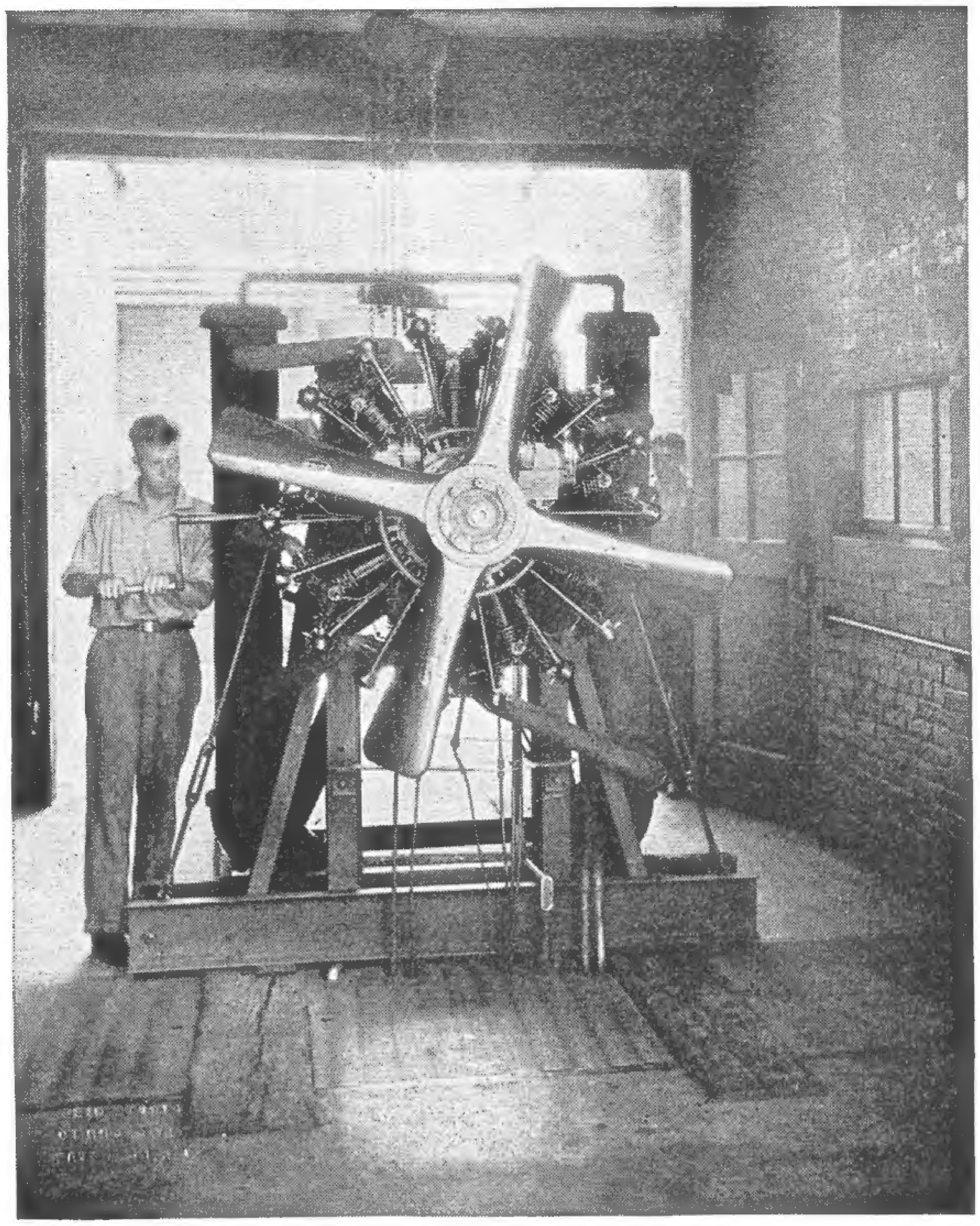


Commander B. G. Leighton, Director Sales and Service

powered with a Hispano. Finally, the transcontinental flight by four Curtiss JN-4-H machines with Hispano-Suiza engines had proven successful, not a single forced landing having to be made because of engine trouble.

A thorough survey of the existing aviation equipment and the possibilities of development convinced Wright officials that their conservative course, as well as the most advantageous to the national defense, lay in the further development of engines, leaving to others the building of planes. Except for the occasional construction of experimental planes in which the proper performance of their engines might be noted, the company has maintained this policy to the present time.

Such policy necessitated early in 1920 the dissolution of the Wright-Martin Aircraft Corporation and the formation of the Wright Aeronautical Corporation under which name the company now operates. Work on the 150 horsepower type "I" engine, the 180 horsepower type "E" engine, and the 300 horsepower type "H" engine went on apace at the new plant at Paterson, N. J., equipped with the most precise tools and machines for engine making in the world. Improvements on the Hispano-Suiza types became so radical and so frequent that the new engines were termed "Wright," as they now are in fact.



Wright Whirlwind engine on test stand ready for production run

These changes in the French types were in the nature of simplifications to give larger operating life and easier maintenance; V magneto brackets, dry sump, gasoline gear pump, thicker heads and more accessible connections.

Records by these new engines continued to mount. On Thanksgiving Day, 1920, a stock Thomas-Morse N.N. B.-3 single seater fighter, powered with a 300 horsepower Wright engine finished second in the first Pulitzer race on Long Island, with a speed of 168½ miles per hour, the winner with a 600 horsepower engine finishing only 2½ minutes ahead by less than 10 miles per hour faster.

A similar Thomas-Morse with Wright engine had in February, 1919, broken the world's speed record with 163 2-3 miles per hour. Wright engines also won fourth and fifth places in this first Pulitzer.

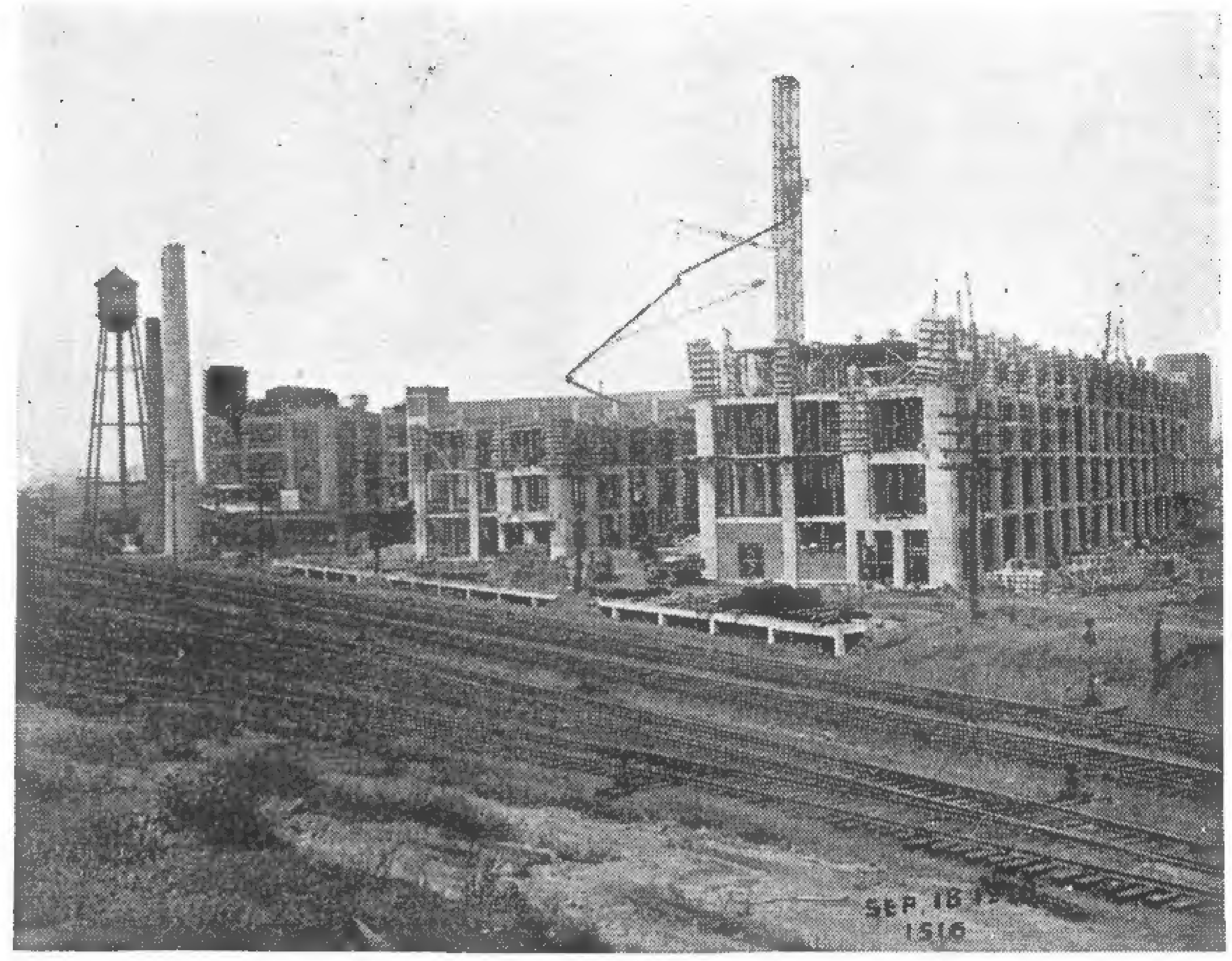
Another noteworthy Wright performance in 1920 was the

J. F. Prince, Sec'y. and Treasurer

H. W. Roughley, Quality Manager

Major C. H. Biddlecombe, Advertising Manager

The Wright Plant in 1920



Construction of new wings

production of a cannon motor for the army by which 1½ inch shells were fired through the propeller shaft while the plane was in flight.

The trip of two American Standard-Wright planes from Chihauhua to Mexico City, the first to enter Mexico as commercial planes, was also an aeronautic landmark for the year.

The thorough dependability of the E-2, 180 horsepower engine was shown in 1920 by a novel test by the army at McCook Field, the purpose being to determine the length of time the engine could be operated in the air without repairs or overhaul. No one was informed that a special record was being made. The flights were as called for in the day's work. When the test was finally stopped, not because of the engine but because the plane was to be otherwise used, the engine had 183 hours, covering 16,500 miles, without a single repair. On examination the engine was found in splendid condition ready for a continuation of the run.

While today a run of 300 hours without repair on a Wright engine is not exceptional, a record of 183 hours in 1920 was a feat of which the company is justly proud.

Planes of 1920 in which Wright engines were used included, for the Navy, the Vought one-place training biplane, the Loening one and two-place monoplane, Curtiss training and torpedo carrying seaplanes, and the Aeromarine seaplane. For the army, they included the Curtiss training "J" types, Vought advance training biplanes, D. H. observation types, ordinance pursuit planes, a Verville pursuit plane and several experimental types.

Proof of the perfection which the Wright 300 horsepower engine was approaching in pursuit planes was amply shown in the Pulitzer races in 1921 at Omaha when Lt. John Macready, flying one of the Thomas-Morse type, took second place with a speed of 160.71 miles per hour. A similar plane and engine, flown by Col. Harold Hartney and considered the fastest in the race and a sure winner, met with accident in the first lap.

The company developed also in 1921 a remarkably efficient dirigible engine, completing the design, the building and the testing in nine months. This was a six-cylinder type, bore seven inches, stroke eight inches, with displacement of 1850 cubic inches and 400 horsepower at 1400 revolutions per minute. This was a larger engine than had been used for service anywhere else in the world.

Work continued toward perfecting the "I" 150 horsepower type, the "E" 180 horsepower, the "H" 300 horsepower, and experimental work on even higher powered types. The dependability which users of these engines began to expect is shown in the record from November 1, 1920, to March 22, 1922, of an "I" engine—No. 47,388—which ran 683 hours without overhaul.

About this time there was developed one of the most remarkably efficient water-cooled engines ever built, the Wright "T" twelve-cylinder type, designed in cooperation with the United States Navy primarily for seaplane use. This engine had a displacement of 1947 cubic inches and at the start was rated at 525 horsepower at 1800 revolutions per minute. Later this power was lifted to 600 and again to 675 horsepower.

With this type of engine, the T-2, experiments in the early part of 1923 in a Navy-Wright sesquiplane developed a speed of 207 miles per hour although durability was the prime requisite sought—and obtained—in the engine. Today this type engine represents the most durable and efficient water-cooled aviation engine in America and is still extensively in use. A variation was also introduced in marine work and with such engines were made the records of many speed boats, including the famous "Teaser," which defeated the Twentieth Century Limited between New York and Albany.

It was prior to all this however, in the 1922 Pulitzer races at Detroit that the wide range of Wright engines and their choice by many manufacturers of planes afforded an excellent opportunity for performances. In the Pulitzer itself the Thomas-Morse used the H-3, 400 horsepower; Booth and Thurston developed two Bee-Line racers of radical design and appearance powered with the same engine; the Wright Company itself powered the N. W. 1., seaplane sister ship of the N. W. 2 mentioned above, with the new 600 horsepower engine; two Verville-Sperry and one Sperry, all three with the

H-2, 350 Wright engine, were other contestants. Two of the H-2 engines were also utilized in the Liberty Engine Builders Trophy race, in XB-I-A experimental observation types.

In the Mitchell Trophy race, all of the entries, M-B-3 planes, which had previously transported the First Pursuit Group from Kelly Field to Selfridge Field with a perfect record, were powered with the H-2 engines exclusively, the winner averaging 147.8 miles per hour.

Another interesting experimental type of this period was the Wright all-metal pursuit plane, the result of combination of effort of the Zeppelin Company of Germany and the Wright company, powered with a Wright 400 horsepower and made entirely of duraluminum.

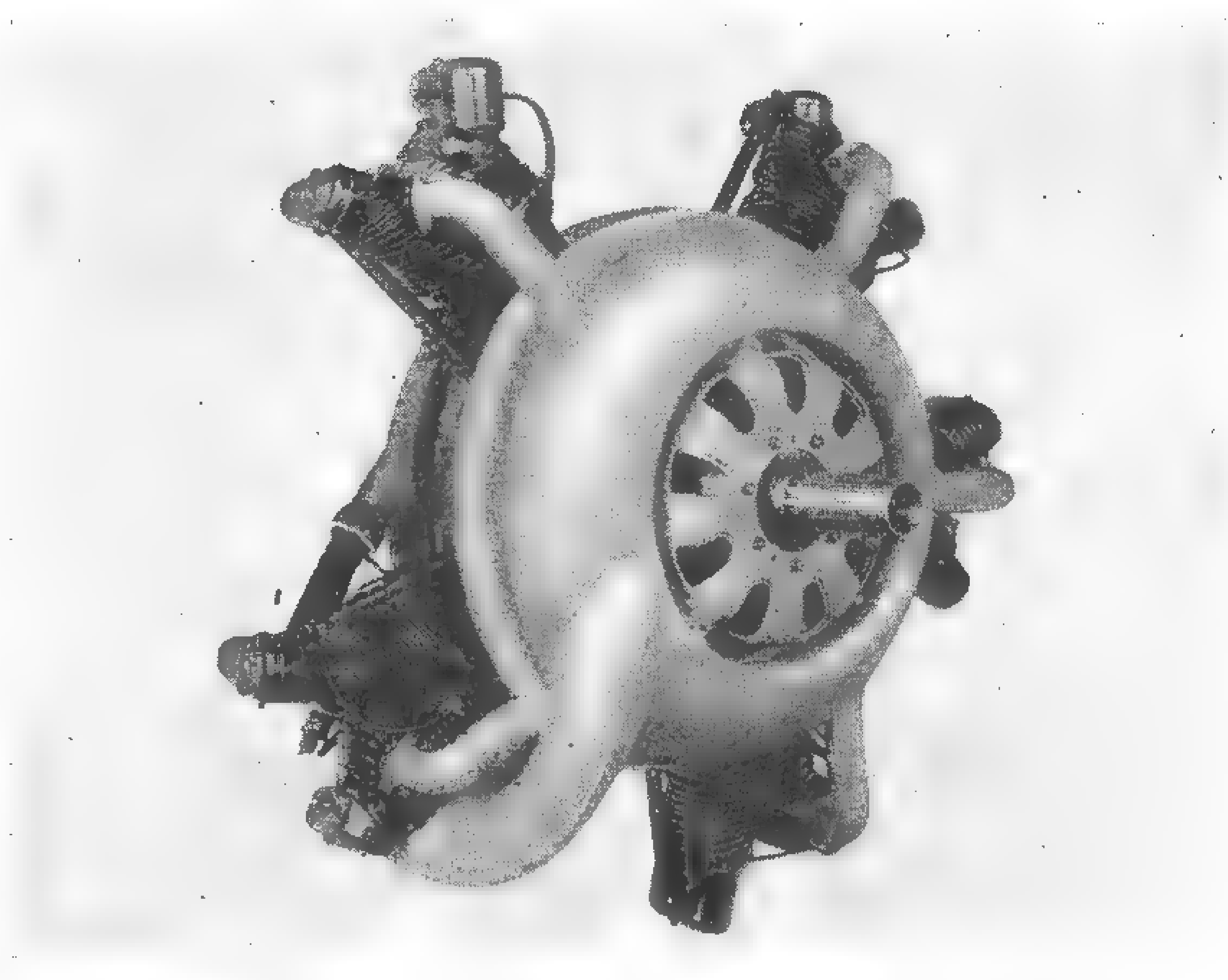
Not content with developing its engines, the Wright company also announced at this time a process by which it developed new cylinders for the Liberty engine, similar to the construction of the E-4 and T-2 cylinders, increasing the power of the Liberty ten per cent and obtaining much greater durability.

The Company had started the development of an air-cooled engine in 1920, and in 1923 the Lawrance radial air-cooled engine was acquired. This resulted in the final evolution of the "J" type, the best known and most popular engine today in either commercial or government use.

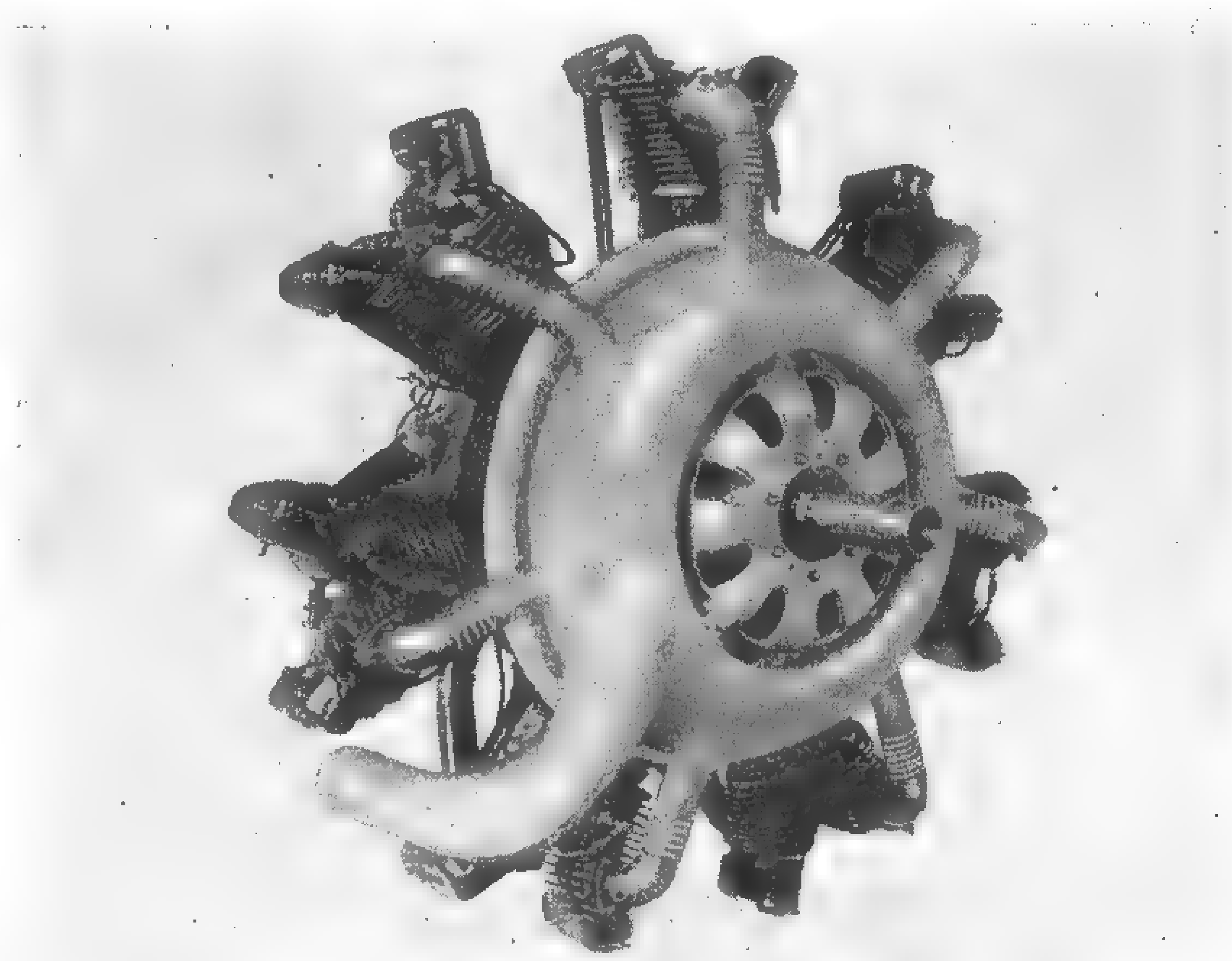
The early history of the air-cooled engine is interesting. In 1914 Charles L. Lawrance, a pioneer in American aviation engines, had become interested in air-cooled types and began the manufacture of these on a small and experimental scale, developing two-cylinder and three-cylinder types. In the course of development came the World War and as these engines were not sufficiently advanced for general military use, they played no important part in the conflict. The English, however, became interested in air-cooled types and in 1919 began a building program of such engines.

In this country the Army tested the Lawrance three-cylinder engine and scenting its possibilities after it had passed a successful test of fifty hours, gave the Wright company an order for the design and construction of a 350 horsepower engine of this class. The "R-I" was then built and passed its test run well, the first large air-cooled radial engine to be operated satisfactorily in America.

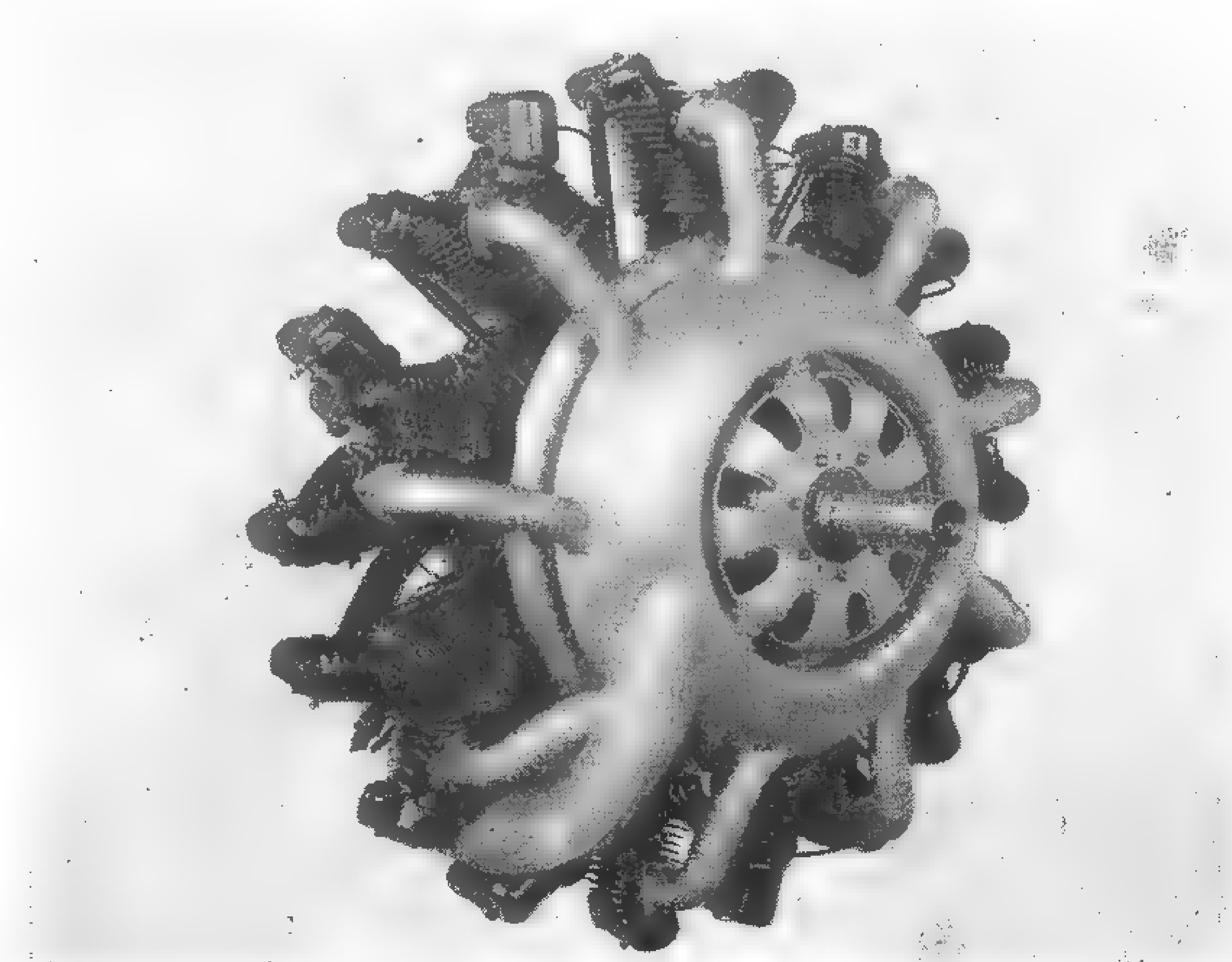
Wright Whirlwind Master and Articulating Rod Assembly



Wright "Whirlwind-Five" 165 horsepower engine

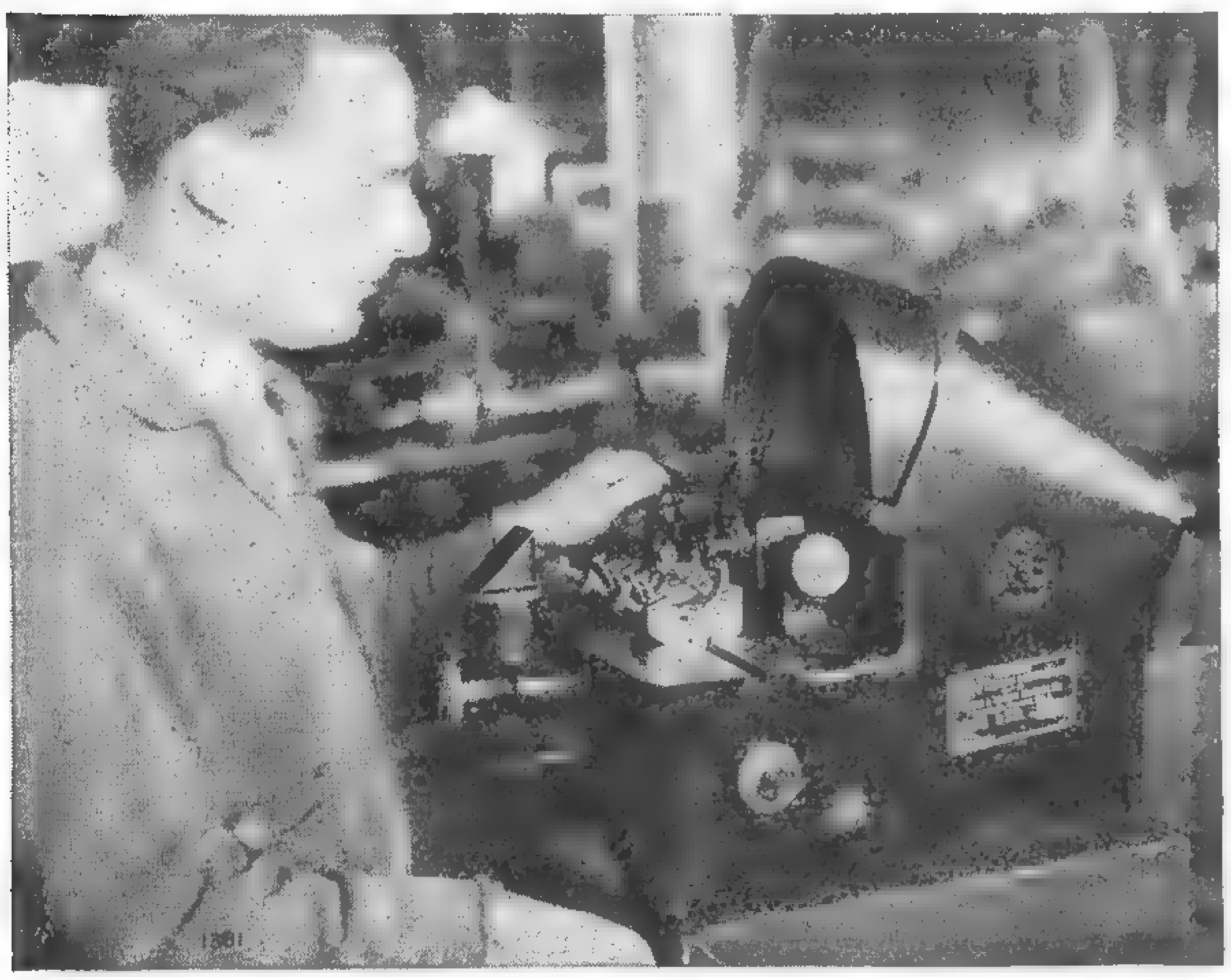


Wright "Whirlwind-Seven" 225 horsepower engine



Wright "Whirlwind-Nine" 300 horsepower engine

Pouring the metal for cylinder head castings in the Wright foundry



Checking screw thread on a special testing machine

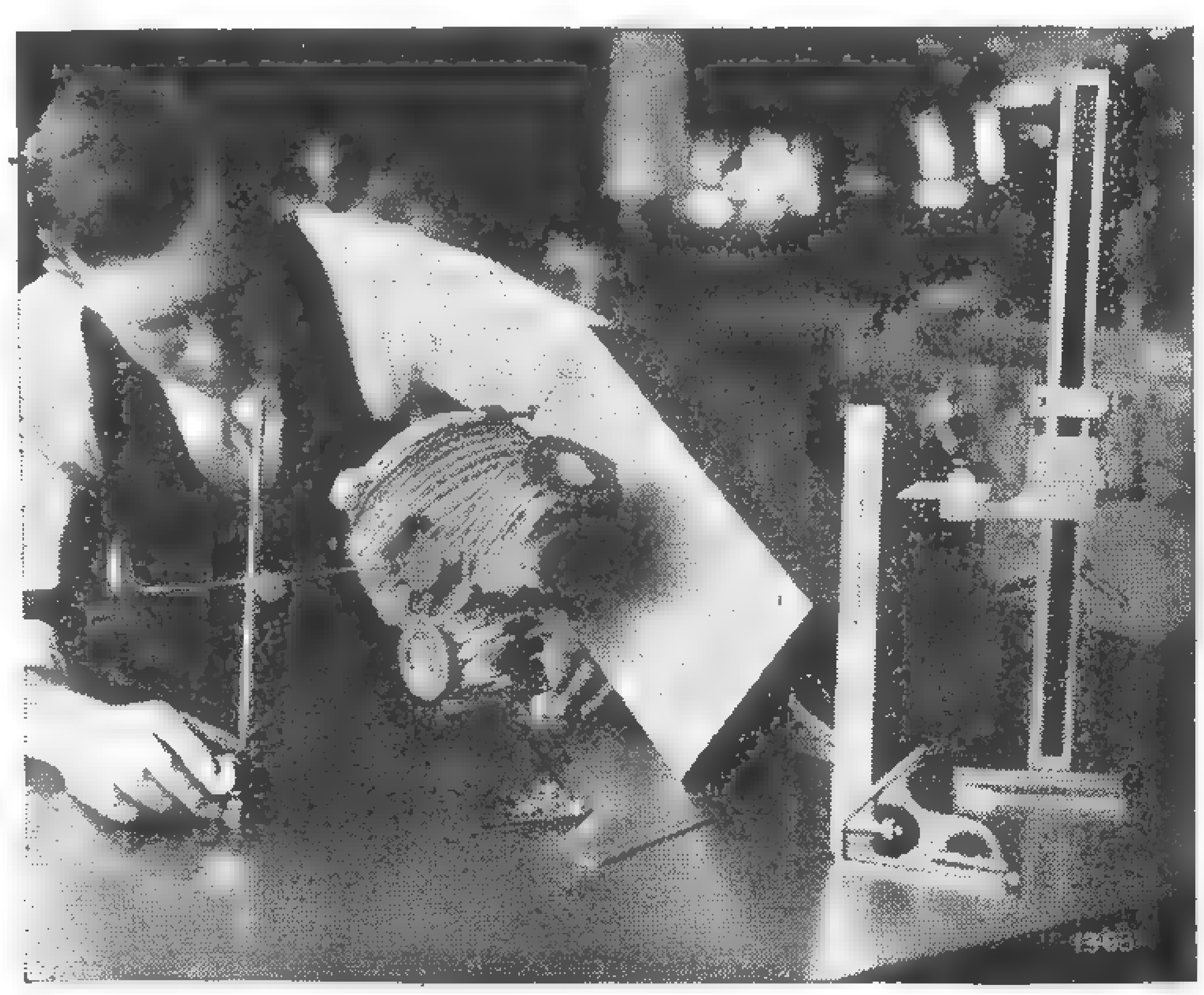
In the meantime both the Army and Navy decided that nine-cylinder air-cooled fixed radials would be valuable in producing 150 to 200 horsepower types and gave the Lawrance company contracts for two sizes of these. The smaller has since become obsolescent but the larger became the "J-I," forerunner of the types which today power the most advanced airplanes ever designed in America.

Convinced of the excellence of the Lawrance engine, which showed its merit in winning the Curtiss Seaplane Trophy Race at Detroit in 1922 after all other contestants except a Wright engined plane, had failed to finish the grueling contest, the Wright company acquired by merger the assets and business of the Lawrance company. Mr. Lawrance first became vice-president of the Wright company and later president, continuing the important work of perfecting the air-cooled type engine to the advancing commercial needs and the demands of the Navy for a strong, reliable fighting engine.

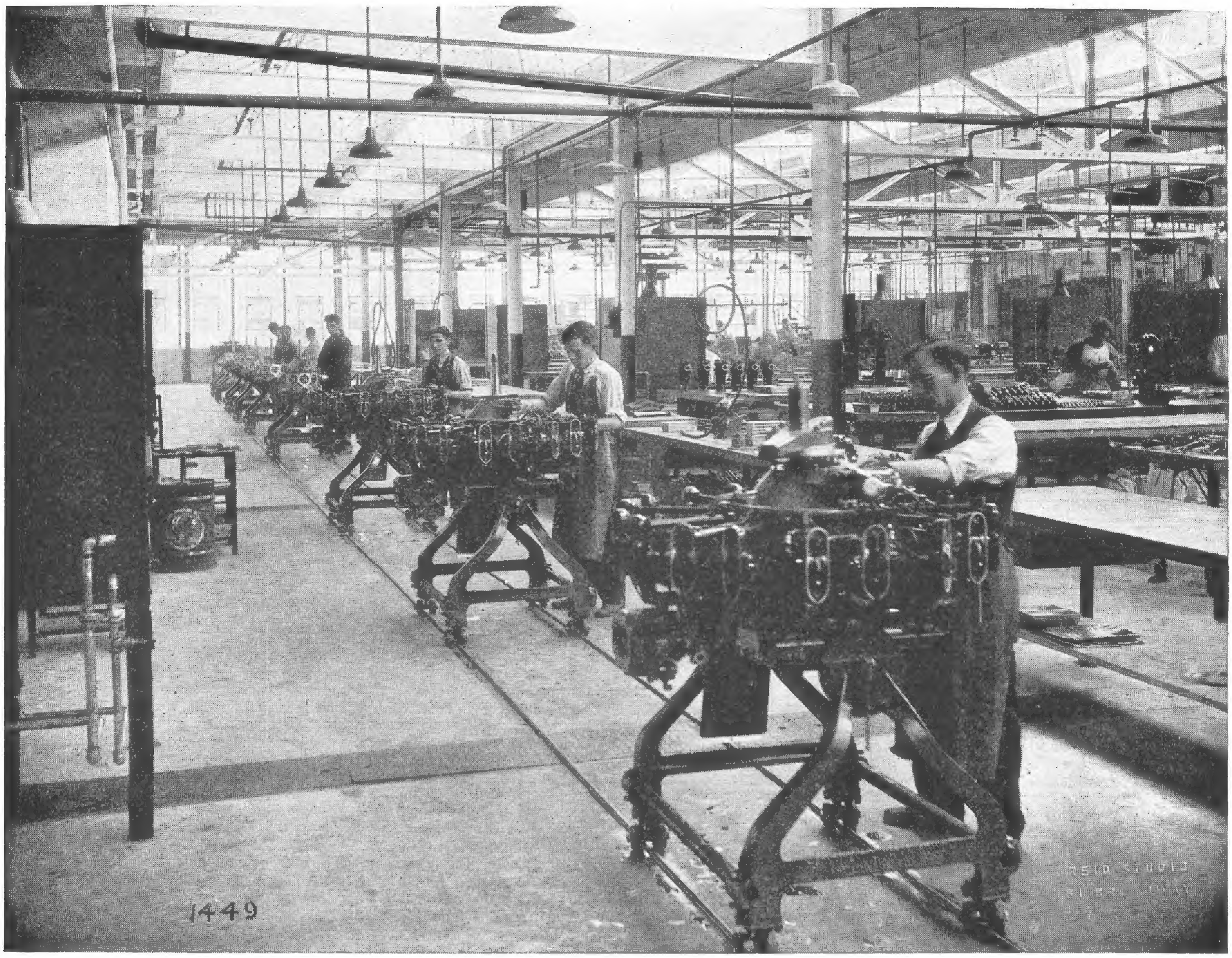
The "J-3" added a number of refinements and improvements and later came the "J-4" the most remarkable of the type and the engine which sprang so rapidly into favor and almost universal use. The Navy at once made this engine its stock power plant for planes requiring 200 to 300 horsepower. Commercial airplane manufacturers began to utilize it because of the reliability and the large airplanes brought it into world-wide notice as the perfect type for use where three engines were required. In the observation plane race at the Pulitzer races in St. Louis, where Wright planes finished third and fourth in the classic, this "J-4" had its first competitive test in a service type Vought. Carrying two men and a useful load this plane finished second, only four minutes slower over the 186 miles than the winner, which had twice as powerful an engine and a metal propeller. The Wright-Vought plane in this race was faster than any of the standard D. H. observation planes, heretofore considered leaders in this class.

An early commercial use of this engine was in the Huff-Daland cotton-dusting planes in the south where dependability was essential because of its operations at considerable distance from the base and at low altitudes over impossible landing places. Their record has been such in this work that each year sees more of these engines in the Huff-Daland dusting fleets.

Cutting fins on the steel cylinder barrel



Centering the spark plug hole on the cylinder head



The primary assembly line at the Wright Plant

Other early users of this engine were the Glenn Martin company, Thomas Morse, Boeing, Dayton-Wright and Gallaudet.

So successful were the "J" type, 200 horsepower air-cooled engines that the Wright company next experimented in fields of higher power and in 1925 announced the "P" air-cooled type, an engine developed from the "J" nine-cylinder type but having a strength of 450 horsepower, lighter and yet more powerful than the famous Liberty of wartime and because of its air-cooling principles devoid of the dangers of water-cooled types.

More recently Wright has announced a new series of Whirlwind engines. They are known as the J-6 series. There is the five-cylinder 165 horsepower engine, the seven-cylinder 225 horsepower engine, and the nine-cylinder 300 horsepower engine. The largest of Wright engines, the 525 horsepower "Cyclone," will supplement the new engines.

The new Wright J-6 series will replace the famous J-5's. The new series of engines embodies further advances in aviation engine design typical of the well-tested improvements regularly introduced in Wright engines to meet the changing demands of the aeronautical industry. The new engines are lighter and have greater power output in proportion to their displacement.

By Wright custom names of winds were given to their engines, the 200 horsepower engine becoming the "Whirlwind," the 325 horsepower the "Simoon" and the 450 horsepower the "Cyclone."

Similar trade names were given to the water-cooled and marine engines, the list of the group being as follows:—

T-3 600-675 H.P. water-cooled engine..........Tornado
T-3-M 600 H.P. marine engine..........Typhoon
E-4 200 H.P. water-cooled aviation engine..........Tempest
E-4-M 200-240 H.P. marine engine..........Gold Cup
J-4 200 H.P. air-cooled aviation engine..........Whirlwind
L-4 60 H.P. air-cooled aviation engine..........Gale
R-1200 325 H.P. air-cooled aviation engine..........Simoon
R-1750 525 H.P. air-cooled aviation engine..........Cyclone

Proof of the fighting ability of the new air-cooled engine was shown recently in the Wright "Apache" a small easily maneuverable biplane, built for shipboard duty with the fleet, and capable of taking off or landing on airplane carriers. Tested first with the Whirlwind the plane performed remark-

ably and later with the Simoon the performance was raised to a pitch exciting the enthusiasm of the Navy.

Proof of the commercial availability of the Whirlwind was shown in another Wright-built plane, the Wright Bellanca, considered as the most advanced commercial-carrying plane designed to date. The proof of both plane and engine was shown in their winning easily at the Pulitzer races of 1925 at Mitchell Field the Efficiency Trophy race for commercial types, no other plane coming within fifty per cent of the Wright-Bellanca record. That is, on efficiency in winning the race, judged on horsepower and speed, the Wright entry won 502 points, the nearest competitor having only 394 points.

The same exemplification of three-engined safety is shown in the Ford-Stout all-metal monoplanes, being manufactured by the airplane division of the Ford Motor Company, and powered with the same Whirlwinds.

The first picture in the portrait of the Wright engine is the foundry room. Here special furnaces melt down the aluminum preparation used in the cylinder heads and other small parts of the engine. The molten metal is poured into small ladles and then taken to sand cores, which are formed nearby from wooden patterns.

The aluminum is poured into the cores; it cools; the sand is chipped and broken off, and the rough casting is given preliminary shaping. Loaded onto trucks, the rough castings are moved to the machining departments. At the same time drop forgings, and other supplies arrive at the railroad siding alongside the plant. They are moved from stockrooms into a testing room where all rough supplies are given hardness tests. Each drop forging is thoroughly tested in the rough before it is accepted for machining.

Other testing rooms are located throughout the plant, some for testing valves, rings, nuts, bolts, and other supplies obtained from outside sources. Skilled workmen subject these parts to the most rigid tests.

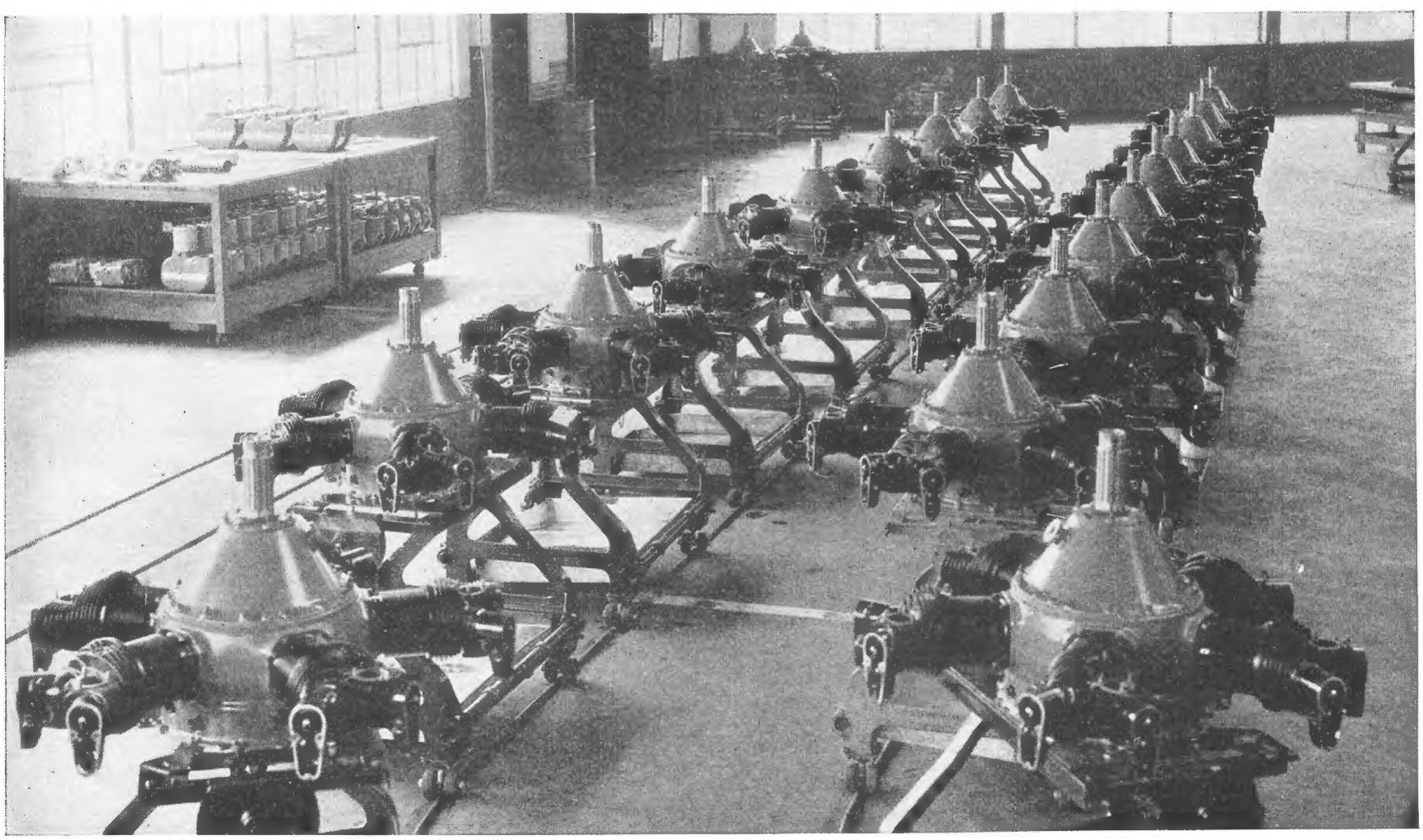
In many ways the Wright factory resembles leading automobile plants. One distinct resemblance is the vast amount of machining, and treating operations required before assembly is begun. Practically nine-tenths of the floor space of the factory is utilized for operations preceding assembly.

The second picture in the construction of the engine is the machining section. Here machines are busy boring, facing, and trimming cylinder heads, boring and facing cylinders and sleeves. Other machines shape up the rough drop forgings into crankshafts. Huge Bullard six-operation machines machine the cylinder heads, and cylinder sleeves, all six operations being conducted simultaneously on the same machine.

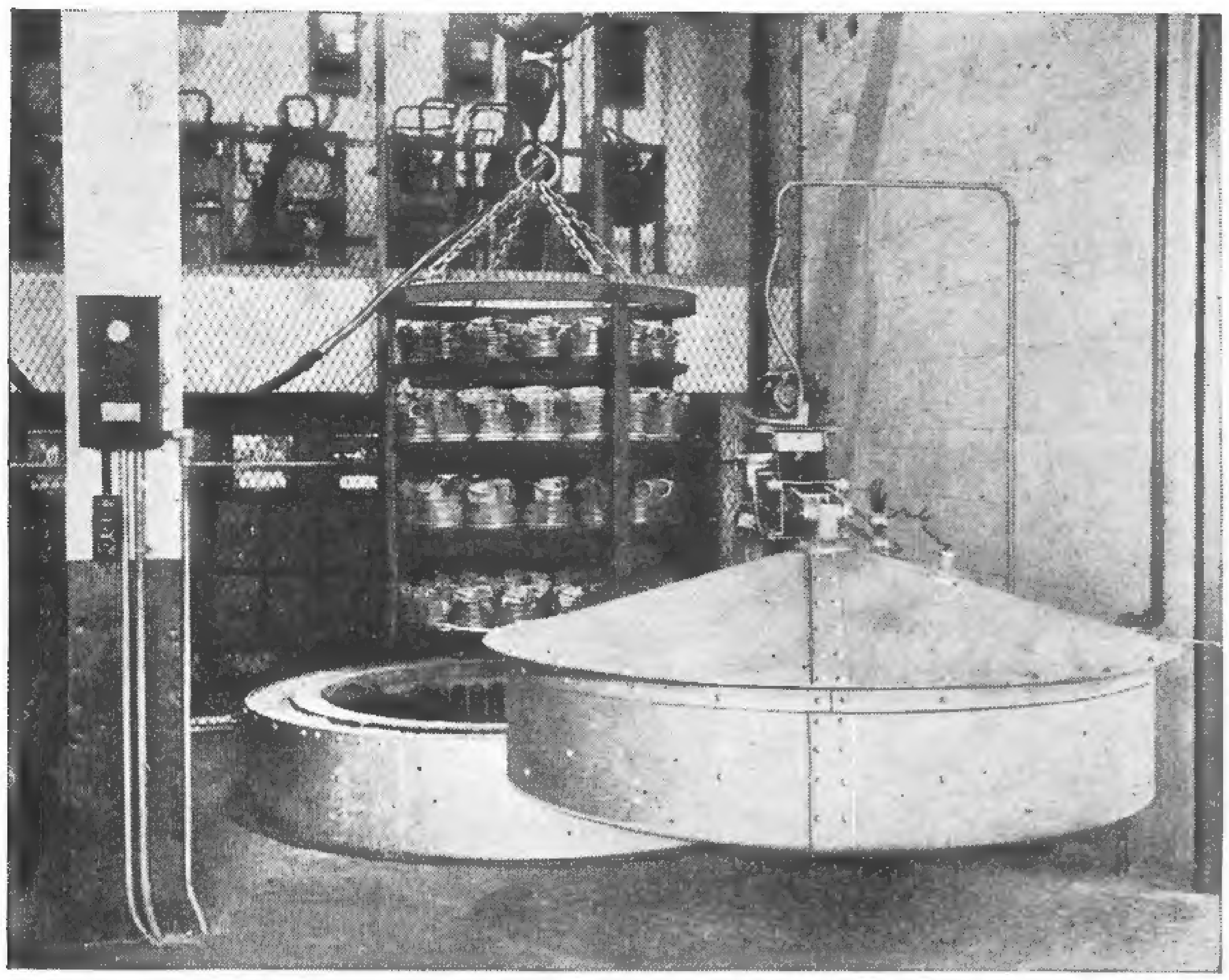
After the exposed parts of the Wright engine are machined, they are taken to the heat treating rooms. Here the parts are parcolaced—a special operation by which parts are made rust proof.

All the castings are given an extra-hard crust by oil treatment. The castings are heated in furnaces; then removed by pneumatic hoists and given baths in oil tanks, in which successively cooler temperatures are constantly maintained.

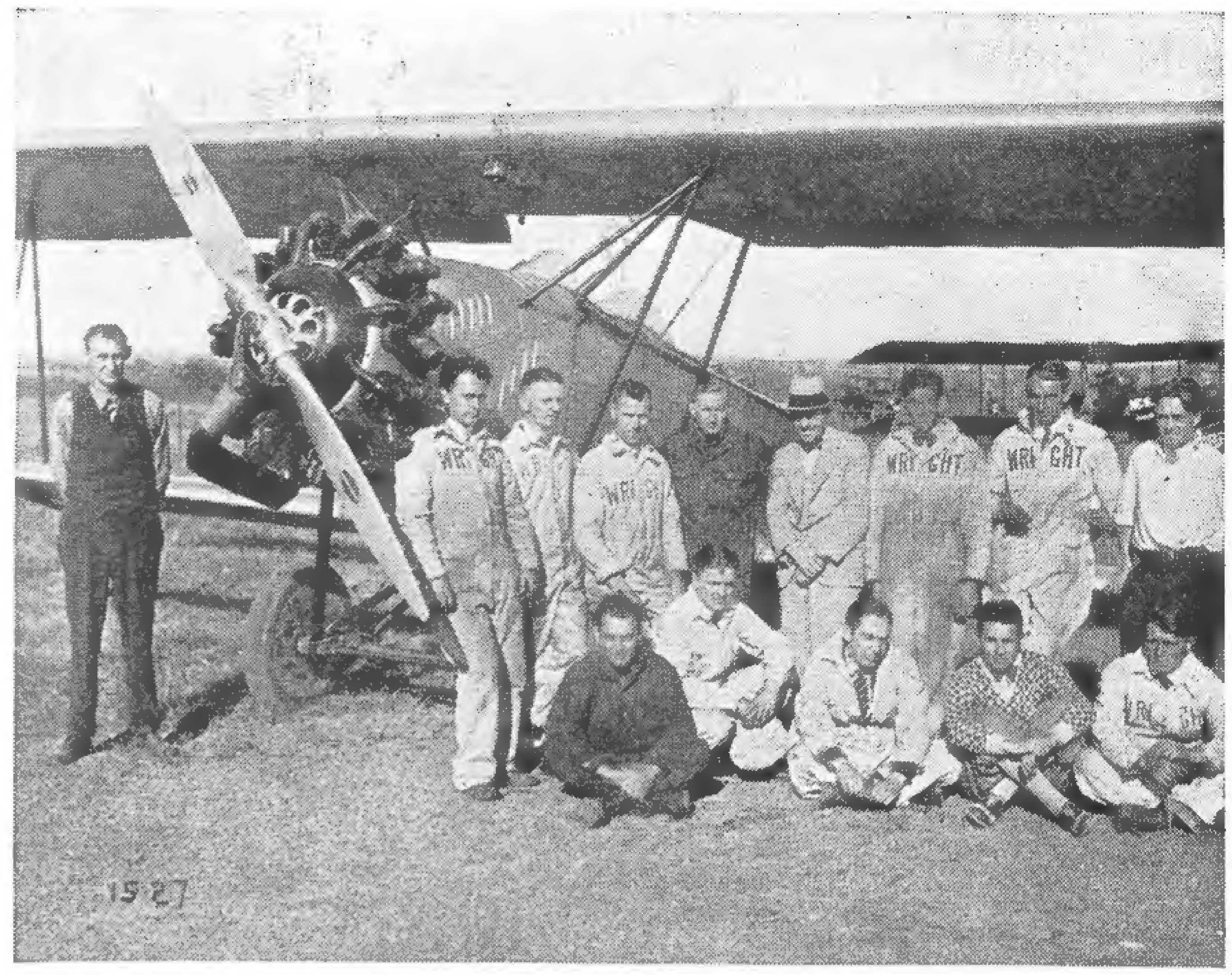
The next item in the picture is the joining of the cylinder head to the cylinder sleeve. The head is of an aluminum alloy, the sleeve of steel. The finished head is first heated,



One day's production of "Whirlwind-Five" engines



Aluminum parts receiving oil bath treatment



Wright Service crew at Teterboro Airport

causing it to expand. Then it is screwed on to the sleeve, which is cold. The operation is performed by hand. When the head cools the aluminum contracts and locks the head to the sleeve.

Meanwhile, in another department spot welding of manifolds and other small parts is done. Electric spot welding machines are used.

After the cylinder head has been joined to the sleeve, the unit is moved to the painting room where the paint is sprayed on, and then enamel baked in electric furnaces.

On the floor above are the buffing machines. Here the machined parts are buffed and polished to a mirror-like smoothness. After buffing the parts are taken to test rooms for a rigid inspection. In each testing room, whenever any part does not measure up to every requirement, it is thrown out. So little as a small scratch on a crankshaft will cause its rejection.

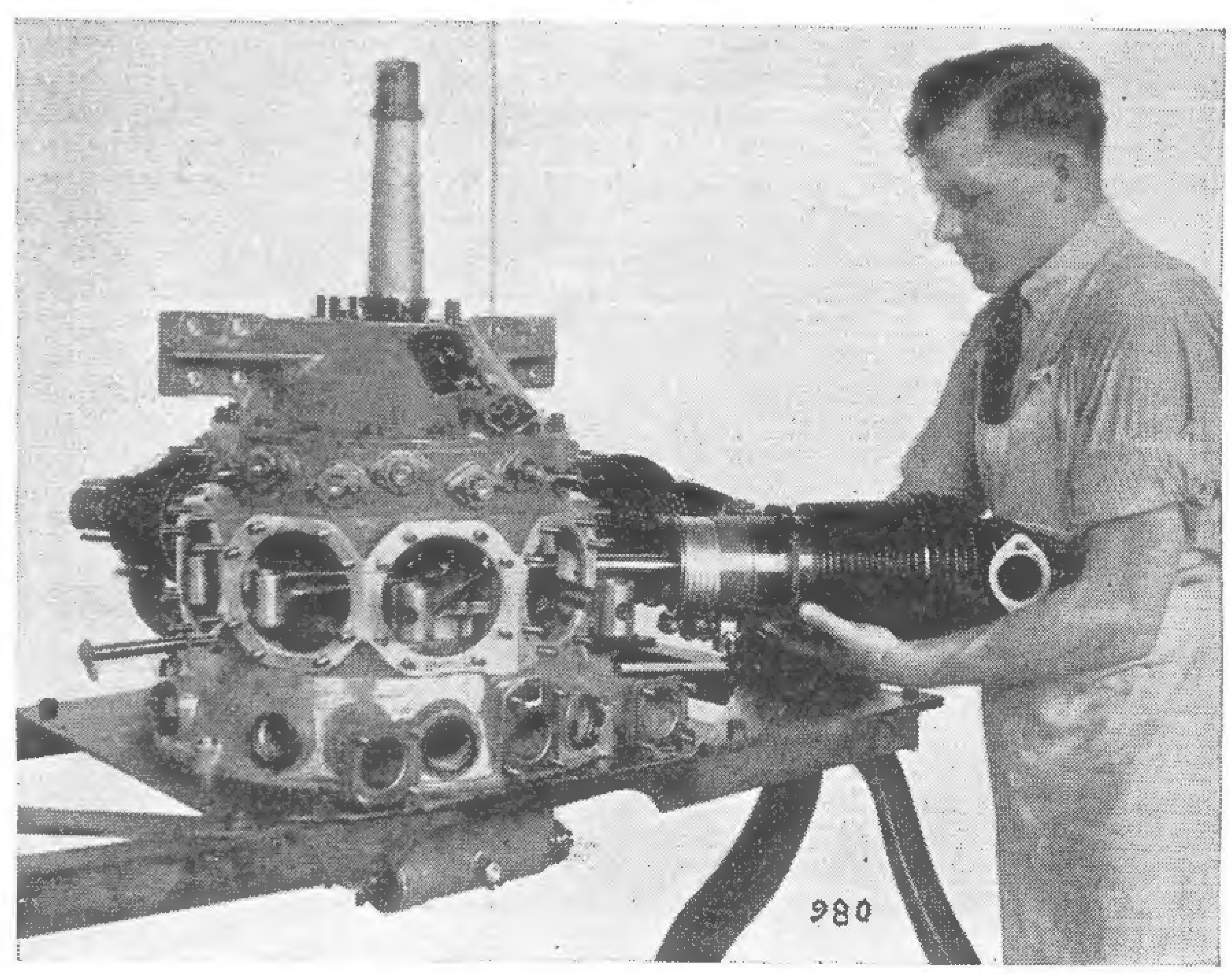
After the parts have been tested and approved, they are moved down to the assembly floor, and are placed in stock shelves. It is here that the Wright engine is completed.

The picture begins to take shape. As one enters the assembly floor, one is struck with the fact that the engine must draw some of its beauty from the place where it is assembled. On the right are the stockroom shelves stretching down through the building. Part assembly lines run out at right angles from the shelves. At the end of the part assembly lines and running at right angles to them, is what resembles a narrow gauge railroad line. This is the primary assembly line.

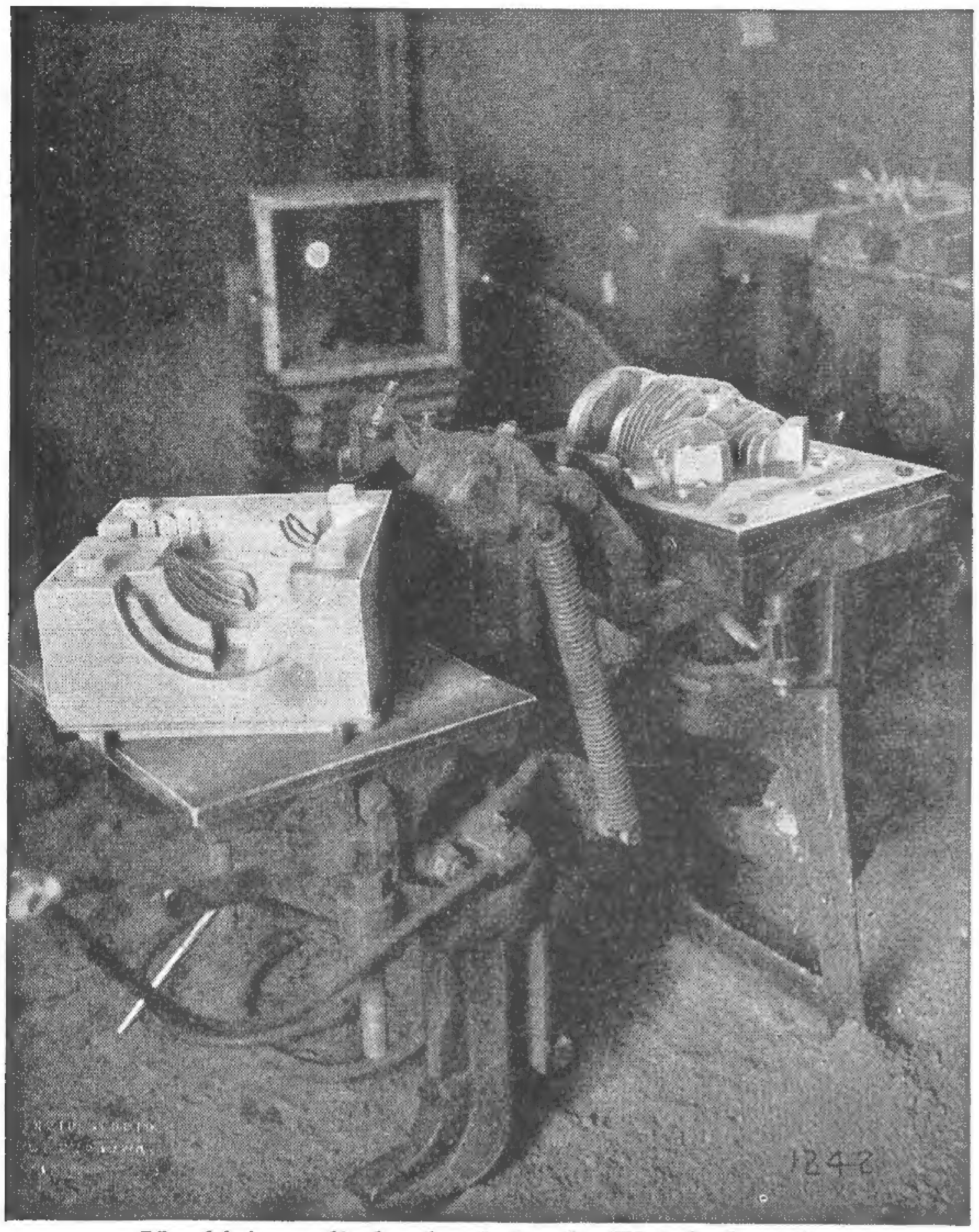
The assembly starts at the stock room shelves. Each part assembly bench draws from the stockroom the finished parts that it must assemble. The crankcase is tapped and smaller parts are attached to it. On another line the crankshaft moves down. On others the cylinders are fitted. On another the master rod is connected to the piston, on which the piston rings have been placed. The "baby" or articulating rods are connected with their pistons on other benches.

At the beginning of the primary assembly line, a four-wheeled table waits to begin the assembly. At the first bench

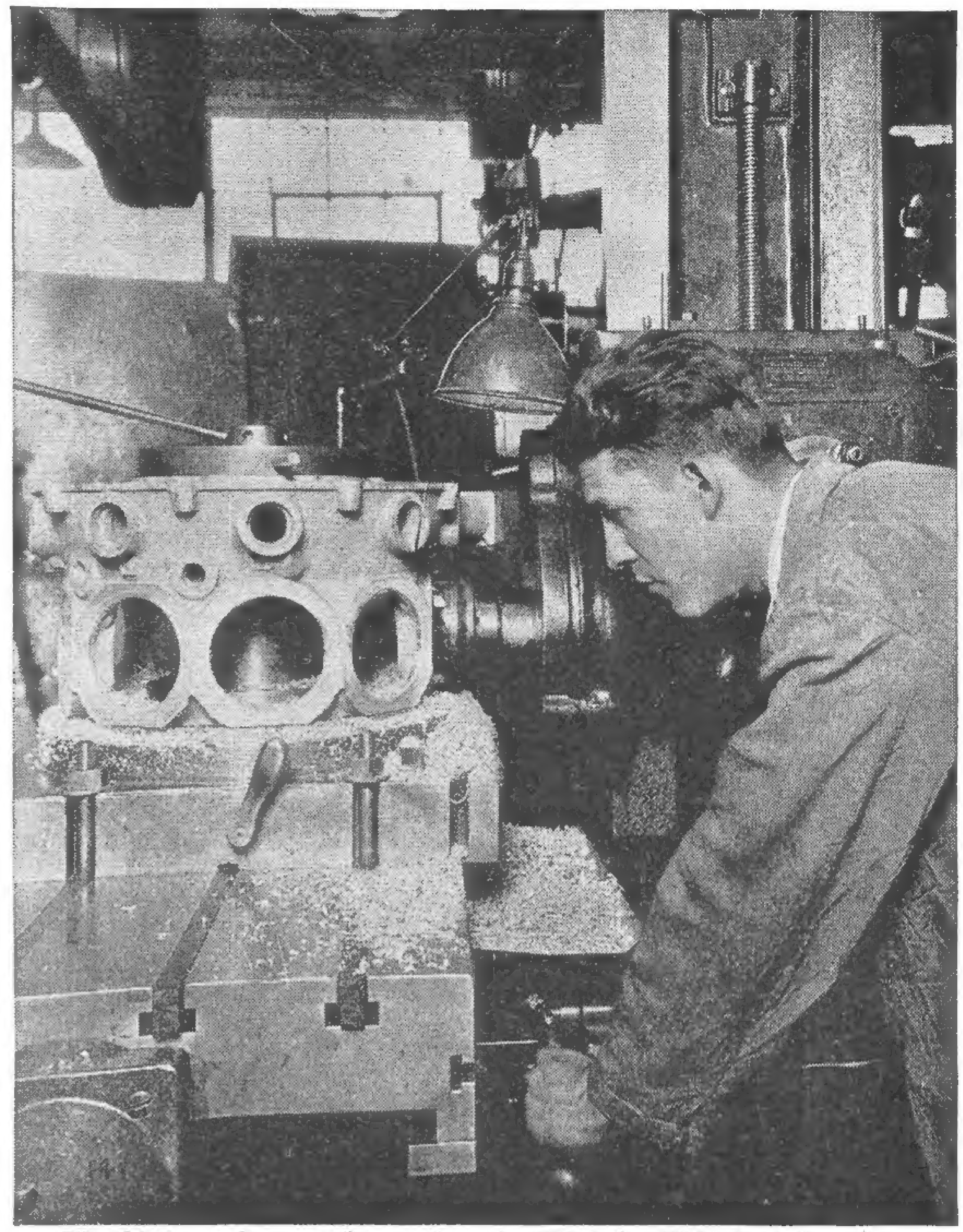
Engine disassembled after test run for inspection and reassembly



Assembling cylinders to crankcase on main assembly line



Mould for cylinder heads in the Wright foundry



Machining the crankcase for the Wright Whirlwind engine

the crankcase is placed on the table. Then, as the table is rolled down the line, the crankshaft with its bearings is inserted into the crankcase. Next the master rod is attached to the crankshaft. Following come the link rods with pistons attached which are attached to the crankshaft and locked to the master rod.

As the table moves along, the intermediate section of the engine with the valve tappets assembled is hooked on. Then the camshaft is attached, the cam driving gear put on—a spacer is inserted—and finally the assembled front section is installed.

The engine is nearing completion. In order the cylinders, with valve rockers and boxes, valves and springs attached, are bolted on to the crankcase and palnuts are installed.

Following come the push rod housing and the push rods, the spark plugs and intake manifold, and the magneto. Finally the wiring on the engine is done, the valves are adjusted, magnetos are synchronized, carburetor and manifold assembly are installed, the rear section assembly attached, and the rocker box covers are screwed on. The Wright engine is finished.

But not yet; the engine must undergo its tests. The finished engine is moved over to the testing room. Here it is mounted on a testing block, a four-bladed wooden propeller attached and the engine is started, to run for five hours. In a small room to one side of the testing room is an observer who notes all data on the performance of the engine at every single minute during its block test. When the test is finished, and the running data assembled, the engine is taken back to the assembly floor.

Here it is broken down part by part, washed, then each part inspected and tested for possible flaws. Corrections are made as the testing data warrants. The disassembled engine then goes to the secondary assembly line for reassembly. The same process of assembly again takes place. The completed motor is then weighed dry, an item of considerable importance to the purchaser of an engine. Finally it is taken again to the testing rooms, where the motor is run for two hours while a final check is made on its performance. If it passes this test, the engine is crated for shipment and moved to a loading platform in the rear of the assembly floor

This then, is the story of the making of the Wright engine. But it is not all. There are other departments which contribute in no small measure to the manufacture of the motor. There is the service department, adjoining the assembly line, where Wright engines are sent for overhaul by their owners. There is the draughting and designing rooms where machines for tooling and improvements in the engine are conceived and executed. There is the experimental floor where Wright engineers are constantly searching for new improvements in airplane engine construction and design. This experimental floor has a complete machine shop of its own where experimental parts may be machined without interrupting regular production flow on the machines downstairs.

Finally there are the offices; the cost department, the purchasing department, sales department, and executive departments. It is in all—this Wright Aeronautical Corporation — a mighty thing; a fit and lasting monument to the progress of American aviation.